THE JOURNAL

OF THE

BOARD OF AGRICULTURE

Vol. XXII. No. 4.

JULY, 1915.

THE UTILISATION OF CEREAL OFFALS AND CERTAIN OTHER PRODUCTS FOR FEEDING PURPOSES.

SINCE the outbreak of war, feeding stuffs in general have considerably increased in price, and the farmer who wishes to obtain the most profitable results from his stock will find it necessary to compare carefully the food unit prices of all the food-stuffs available. This is all the more important because in the case of a number of feeding stuffs, especially those which were largely exported before the war, the increase in price has been relatively small, and the stock feeder will be well advised to consider the possibility of utilising some of these more extensively in making up the rations for his stock. Provided it is borne in mind that all changes in stock feeding should be gradual, and that new feeding stuffs should be introduced at the beginning rather than at the end of the feeding period, it will be found that many of the feeding stuffs described in the present article may be substituted advantageously for some of the better known feeding stuffs in general use before the war.

The table on p. 298 gives the present average price and the cost per food unit of 30 feeding stuffs now on the market. The list does not include proprietary articles, such as some of the mixed cakes and sugar feeds, for the reason that such articles have no definite average composition on which an estimate of their content of food units can be based. Anyone, however, who proposes buying such feeding stuffs can make a rough calculation of the food units in the usual way, from the guaranteed analysis of the maker or

seller. From the number of food units thus calculated, about one-fifth should be subtracted in order to get a rough estimate of the number of digestible food units. The price per ton, divided by this final figure, will then give the price per unit for comparison with the standard foods given in the following list. Full particulars of the methods recommended for comparing the value of feeding stuffs by reducing them to food units are given in Leaflet No. 74 (Composition and Properties of Concentrated Feeding Stuffs) which should be read in conjunction with the present article.

	Average price per ton at beginning of July.	Price per food unit.*
	£ s. d.	s. d.
Brewers' grains (wet)	1 0 0	0 11½
Soya bean cake	8 3 0	1 4
Maize gluten feed	8 4 0	1 4¼
Palm-nut kernel cake	6 0 0	1 5¼
Coconut cake	7 9 0	1 5½
Wheat pollards	6 0 0	1 5½
Brewers' grains (dry)	6 6 0	1 6
Wheat bran	5 16 0	1 6
Decorticated cotton cake	9 13 0	1 6½
Wheat middlings	7 6 0	1 6¾
Linseed cake, Indian	9 15 0	1 7
Malt culms	5 16 0	1 8
Wheat bran, broad	6 14 0	1 8
Maize, Argentine	8 0 0	1 8¼
Rice meal, Burmese	6 13 0	1 8¼
Linseed cake, English	10 6 0	1 8¾
Maize germ meal	8 13 0	1 9
Wheat sharps	7 15 0	1 9½
Maize, American	8 10 0	1 9¾
Beans, Chinese	9 17 0	1 11¼
Cotton cake, Egyptian	7 1 0	1 11½
Beans, English	9 15 0	1 11½
Maize meal	8 12 0	1 11¾
Peas, English dun	9 18 0	2 0½
Cotton cake, Bombay	6 15 0	2 0¾
Peas, English maple	10 11 0	2 2
Barley, English feeding	10 0 0	2 5
Oats, Argentine	10 7 0	2 9
Peas, Calcutta white	13 13 0	2 9½
Oats, English	11 14 0	3 1¼

* Calculated on basis of digestible constituents of feeding stuffs (*see* Leaflet 74, p. 8).

It should be understood that the results are based on the average price of an average sample. No allowance is made for differences in prices at the various markets, or for variation in the composition of different samples of the same feeding stuff. The table will serve, however, as a broad indication of the

relative food unit values of food-stuffs at present prices, and by using it as a general guide, the farmer may easily compare for himself the prices of particular food-stuffs relative to their feeding value if he will make use of the methods described in Leaflet No. 74.

The feeding stuffs dealt with in this article are :—

1. Wheat Bran.
2. Sharps and Middlings.
3. Wet Grains.
4. Dried Grains.
5. Malt Culms.
6. Dried Yeast.
7. Gluten Meal and Gluten Feed.
8. Maize Germ Meal.
9. Rice Meal.
10. Soya Bean Cake and Meal.
11. Coco-nut Cake.
12. Palm-nut Kernel Cake.
13. English Beans.
14. Fish Meal.

1. *Wheat Bran.*—Bran is one of the principal "offals" obtained in the milling of wheat. Two forms of bran are sold—the "broad" and the "medium." The former consists mainly of the larger flaky particles of the outer coats of the wheat grain, and especially finds favour for feeding horses; the latter, which consists of the finer particles of the same material, constitutes the bulk of the bran made in this country, and is used mainly for dairy cattle. In composition bran closely resembles the other wheat offals, viz., sharps and middlings, and is not unlike oats. The manurial value of bran, however, is higher than that of oats; according to Hall and Voelcker, the respective values per ton of bran and oats when made into dung are 31*s.* 3*d.* and 17*s.* 11*d.*

Bran is particularly rich in mineral ingredients (lime and phosphates), and it is therefore specially well suited for young growing animals and for brood animals of all kinds both before and after parturition. It is a very palatable food, and this fact, coupled with its well-known laxative influence, peculiarly fits it for feeding in association with such concentrated foods as cotton cakes, bean meal and maize, or with coarse fodders, such as wheat or barley straw, when the supply of roots is restricted. In experiments conducted by the Edinburgh and East of Scotland College of Agriculture in 1910-11 and 1911-12, with two-year-old fattening bullocks, bran proved equal to linseed cake in

respect of the quantity and quality of the beef produced, and was slightly the more profitable feeding stuff. In America, bran has been extensively used as a partial substitute for oats in feeding heavy horses, and has resulted in a very considerable saving in the cost of maintenance. It was found that these two foods might suitably be mixed in equal proportion for horses. At present prices the feeding of broad bran seems to be extravagant.

2. *Sharps and Middlings.**—Sharps is a wheat offal of a grade intermediate between bran and middlings, and it consists, mainly, of fine particles of bran with a certain amount of adherent meal. Middlings represents the innermost layers removed from the wheat grain when making flour, and this offal closely approaches flour in its general character. Sharps contains as a rule slightly more fibre than middlings, but in all other respects the two are very much alike in composition and may conveniently be considered together. In general character and feeding properties they closely resemble bran; they are rather more nutritious than bran, but lack some of the special qualities possessed by that feeding stuff. Sharps and middlings are mainly used in the feeding of pigs and poultry.

Probably these offals constitute the safest "dry" food for pigs for a few weeks both before and after weaning, and also for sows suckling their young. For young pigs they are best fed along with skim milk, buttermilk or whey. After weaning an excellent ration consists of these by-products of the dairy with a mixture of bran or sharps and barley meal. When no dairy by-products are available, a mixture of brewers' grains (fresh), barley meal and bran or sharps may safely be used.

3. *Wet Grains.*—This food is a by-product of the brewing and distilling industries, and represents the residues of the grains (chiefly barley) which have been converted into malt and subjected to thorough extraction with water. It contains all the husk of the barley, a considerable proportion of which is digestible, and also the bulk of the albuminoids or flesh-forming substances present in the original grain; the greater part of the starch will have been removed. It is the

* There is considerable divergence in the grading of milling offals in different parts of the country, but for general purposes they may be grouped into the three classes of bran, sharps (or shorts) and middlings (thirds), the last named being the most like flour in character, whilst sharps (or pollards) are intermediate between this and bran.

cheapest per food unit included in the table, and is largely used for feeding dairy cows. It is very palatable, and the low cost of the food is due to the fact that the difficulties of carriage restrict the consumption of the grains to the neighbourhood of breweries or distilleries, and to the fact that it varies very much in composition. In using wet grains special care must be taken that they are delivered fresh, and that no more are given to the animals than can be consumed without causing scour. Over-feeding, especially after storage, is apt to lead to digestive disturbances. Where cleanliness and supervision of feeding are exercised, this feeding stuff is very economical for the production of milk. It is largely used in Holland for fattening old cows for beef.

Occasionally fresh grains are stored in pits for subsequent use in much the same way as silage is preserved. In such cases a little salt is usually mixed with the grains.

4. *Dried Grains.*—For convenience of sale and storage wet grains are frequently dried by machinery.

As a feeding stuff, dried grains are intermediate between undecorticated cotton cake and sharps; in round figures the relative feeding values of the three may be placed at 4 : 5 : 6. There is a good deal of difference of opinion as to the relative feeding value of distillers' grains and brewers' grains. The former are generally the more expensive to buy but if the foods are judged by their chemical composition, there can be very little difference between the two. It must be remembered, however, that while chemical analysis is useful as a guide, it does not afford complete information as to the relative feeding value of different commodities.

Dried grains are much liked by stock and are generally recognised as an excellent feeding stuff for fattening cattle, milking cows, and especially for suckling ewes and growing lambs. As a food for horses they are perhaps less widely known; theoretically 6 to 7 lb. of dried grains should equal 5 lb. of oats, but numerous experiments both in America and on the Continent have shown that, pound for pound and in moderate quantities, they may be equal to oats for feeding horses at ordinary work. At present they are very much cheaper per food unit. Dried grains are quite wholesome and should be given a trial when easily obtainable. Their manurial value consumed at the homestead is, according to Hall and Voelcker, 29s. per ton.

5. *Malt Culms.*—Malt culms, or coombs, consist of the dried rootlets and shoots screened from the kilned malt. High quality culms are light coloured, crisp and nearly free from dust; they possess a pleasant aromatic smell. They vary widely in composition, but may contain about 26 per cent. of crude albuminoids, 1 per cent. of oil, 46 per cent. of carbohydrates and 11 per cent. of fibre. It should be noted, however, that a considerable proportion of the ingredients classed as crude albuminoids are not "true albuminoids," but possess a relatively low nutritive value. Malt culms are highly palatable and digestible and are readily eaten by all classes of stock. They impart a relish to less appetising foods, and are specially suitable for feeding to sheep and dairy cows. Malt culms may be fed in the same way as dried grains and in somewhat similar quantities.

A word of warning is necessary against feeding excessive quantities of malt culms, as they are apt to lead to digestive trouble and may cause abortion in breeding animals approaching parturition. The use of dark coloured culms and culms containing large amounts of dust and other impurities should be avoided. Provided, however, that care is taken to use only good quality culms, farmers will find in them a valuable and economical feeding stuff.*

6. *Brewers' Dried Yeast.*—This by-product of brewing is widely utilised on the Continent as a feeding stuff for cattle and pigs. It contains approximately 48·5 per cent. of albuminoids, ·5 per cent. of oil and 35 per cent. of carbohydrates. The percentage of ash (mainly phosphates) is high. This feeding stuff has not hitherto been much used in England, but its composition, and the fact that it has given excellent results with all classes of live stock on the Continent, show that it is clearly worth the attention of farmers in this country.

7. *Gluten Meal and Gluten Feed.*—These feeding stuffs are residues from the manufacture of starch from maize and one or two other cereals. The former consists mainly of the gluten layer, and is therefore rich in albuminoids. Gluten feed, on the other hand, is the result of a less complete separation of the gluten layer, and contains more fibre and less albuminoids than the meal. Both "meal" and "feed" are fairly rich in oil, but are relatively poor in mineral matter.

Gluten meal is largely used in this country as a nitrogenous ingredient in compound feeding cakes, and is to some extent fed alone to dairy cows. Both of the by-products are

* Information in greater detail as to the feeding of malt culms is given in this *Journal* for June, 1915, p. 239.

extensively used in America and on the Continent for feeding to fattening stock and to dairy cows, the best results being obtained when they are given in conjunction with other concentrated foods. In mixtures they are also suitable for feeding sheep, pigs and poultry. Gluten meal and gluten feed may be used in part to replace beans and peas, which they resemble in composition.

In the few cases in which gluten feed has been used extensively in this country it has given very good results when fed up to 5 lb. daily. In the United States, where it is always fed in conjunction with a light material such as wheat bran, it has been fed with excellent results for dairy cattle and fattening stock.

8. *Maize Germ Meal.*—This meal is prepared by removing the germ from the maize grain and grinding it up separately. It usually contains about twice as much oil as the maize grain itself and slightly more albuminoids. The carbohydrates in the germ meal, which are about 10 per cent. less than in the maize grain, comprise, in addition to starch, a certain amount of sugar. It is this sugar which imparts to the meal its characteristic sweetness. Maize germ meal is a favourite feeding material, particularly for dairy cows.

9. *Rice Meal.*—In preparing the rice grain for human food the outer husks, commonly known as "rice hulls" or "rice shudes," are removed first. These "hulls" or "shudes," which consist principally of woody fibre and are often adulterated with a large amount of siliceous or sandy material, are of little or no feeding value and may even be positively harmful. It is important therefore that they should form no part of rice meal, which should consist of the reddish or bran layer immediately enclosing the white grain of commerce, together with broken pieces of the grain itself.

Rice meal is essentially a starchy food. It is also rich in oil, but it is probable that this is of relatively low feeding value. The meal is particularly valuable for mixing with beans, decorticated cotton cake or with soya bean cake. It should not be used with common cotton cake. Rice meal is useful for pig feeding and may form part of the ration of fattening bullocks. It may also be used to replace to some extent cereal grains in rations for horses. Care should be taken to avoid samples containing more than about 2 per cent. of siliceous material, and, in view of the liability of the meal to turn rancid, large stocks should not be stored.

10. *Soya Bean Cake and Meal.*—Soya bean cake is made from the bean of a leguminous plant (*Soya hispida*). This bean has long been extensively grown in the East, where it forms an important article of human food, but only since 1908 has it been imported in quantity into this country. It differs from the common field bean in being rich in oil. To a small extent the soya bean itself is used as a cattle food, but, as a rule, the greater part of the oil is first removed by seed crushers, the residual cake or meal being used for feeding purposes. In the ordinary course the oil is removed by heat and pressure, the residue being in the form of a cake which still contains a considerable percentage of oil. A soya bean meal, however, is also sold, and from this nearly the whole of the oil has been extracted by means of a chemical solvent.

Soya bean cake usually contains 40-45 per cent. of albuminoids and 6-8 per cent. of oil. It can be mixed without danger with maize gluten feed, and a combination of bean and rice meal. It is usually fed in combination with common cotton cake. At present prices it is a very cheap feeding stuff, but should be fed with discretion as it possesses distinctly laxative, not to say scouring, properties. It is suggested that it should never exceed one-fourth of the concentrated ration. "Extracted" meal is much poorer in oil than the cake, containing only about 2 per cent., but it is correspondingly richer in albuminoids. It should be fed in moderate quantities along with other less concentrated foods. Soya bean cake and meal have a high manurial value, similar to that of decorticated cotton cake, and considerably higher than that of linseed cake.

11. *Coco-nut Cake.**—Coco-nut cake is made from the fleshy portion of the coco-nut after the oil has been extracted. It is not largely used for feeding in this country but is in considerable request on the Continent.

An average sample of coco-nut cake may contain 22 per cent. of albuminoids and 10 per cent. of oil; it is thus not so rich in flesh-forming substances as linseed cake, but in other respects is not dissimilar to that feeding stuff. On the Continent coco-nut cake is favoured as a food for dairy stock. It is damped before use and fed in quantities of from 3 to 4 lb. a day; it is said to be eaten readily. Sufficient data as to its suitability for stock feeding in this country have not yet been accumulated. Theoretically it should be about

* *See also* Special Leaflet No. 20 (*Coco-nut Cake and Palm-nut Kernel Cake*).

equal to linseed cake, and, at present prices, farmers would be well advised to use it as a substitute for more expensive foods in the concentrated rations for dairy cows, and they should certainly give it a trial in feeding for meat production.

12. *Palm-nut Kernel Cake.**—Palm-nut kernel cake is made by pressing the kernels of the nuts of the oil palm, a species of palm that is grown extensively in the West African Colonies and Protectorates. Almost the whole export of this product has hitherto gone to Germany, where large factories have been erected for crushing the kernels and preparing the products for market. It is hoped that it may now be possible to arrange for the crushing of palm-nut kernels in this country. The kernel contains about 50 per cent. of oil, and after crushing is sold in the form of either cake or meal containing about 7 to 8 per cent. of oil and 17 to 18 per cent. of albuminoids. The meal is sometimes further treated with chemical solvents and its content of oil may then be reduced to as little as 1·5 per cent.

Palm-nut oil, which is largely used for human food, is very suitable for certain classes of stock, but there is not sufficient information available to enable a definite comparison to be made between palm-nut and linseed oils. The experience of foreign stock-feeders would appear to indicate that palm-nut kernel cake would make a very good substitute for linseed cake in feeding dairy cattle. Cows may receive up to 5 lb. per head per day.

Palm-nut kernel cake does not keep so well as linseed or cotton cakes, and users should not lay in large stocks.

13. *English Beans.*—Beans are much cheaper per food unit than the cereal grains, and may be fed to advantage in conjunction with any laxative concentrated food. Beans should be used with discretion as they are very binding. With linseed cake they form a very popular finishing ration.

14. *Fish Meal.*—Fish meal is produced from fish offal, and from whole fish which is unsaleable owing to an excessive supply. Provided it has been carefully prepared, fish meal forms a suitable supplementary feeding stuff for farm animals, and may be used with advantage for cattle, pigs and poultry. As most of the fish meal manufactured in England has hitherto been taken by the Continent, it is likely

* *See also* Special Leaflet No. 20 (*Coco-nut Cake and Palm-nut Kernel Cake*).

that it will now be available in some quantity, and that farmers may find it a cheap feeding stuff. The richness of fish meal in protein (55 to 65 per cent.), of which a considerable proportion is easily digestible, renders it specially suitable for combination with other foods relatively poor in this ingredient, such as roots, potatoes, hay, straw, and the starchy cereal grains and offals. If fed in too large quantities, or if it contains too high a percentage of oil, both meat and milk are liable to be tainted. High grade fish meal should not contain more than $3\frac{1}{2}$ to 5 per cent. of oil. Among the mineral constituents present are phosphate of lime and salt, both of which are necessary in the feeding of farm animals. In the case of salt, however, an excess may cause illness, especially in pigs, and for this reason the proportion of salt in fish meal should not exceed 5 per cent. As a result of the experiments which have been conducted by stock-feeders it is suggested that the following quantities might be given daily to the different kinds of farm stock:—

Cattle—2 lb. for every 1,000 lb. live weight.
Pigs—$\frac{1}{4}$ to $\frac{1}{2}$ lb., according to weight.
Sheep—$\frac{1}{10}$ to $\frac{1}{5}$ lb. for every 100 lb. live weight.

For poultry feeding, fish meal with a low percentage of oil and salt should be selected, and the birds should be gradually accustomed to the food. Adult fowls should receive not more than 10 per cent., and chickens not more than 5 per cent. of their whole diet in this form.*

Compiling Rations.

In compiling rations for the various classes of live stock it is desirable to select those feeding stuffs which, although not necessarily the cheapest absolutely, are the cheapest for the purpose in view. Where an abundant supply of grass or similar succulent green fodder is available, it is not usually necessary in the case of ruminant animals, or animals at slow and easy work, to feed much concentrated food in addition. The chief use of a concentrated food is to supplement one or more of the ingredients that may not be present in sufficient quantity in the fodder upon which the animal is feeding.

As autumn approaches, pastures usually begin to fail, or at all events they become less sustaining by reason of the

* Further information as to the feeding value of fish meal will be found in this *Journal* for November, 1914, p. 688.

fact that a large proportion of the plants then reach maturity. It usually becomes necessary, therefore, at this time to add to the food ingredients of the diet by the use of concentrated feeding stuffs. The chief requirement in this respect is generally albuminoids.

For dairy cows, a judicious blend of two or more of the following feeding stuffs will probably be found the most suitable and economical at the present time :—Linseed cake, coco-nut cake, maize gluten feed and brewers' grains. For well-grown store cattle a selection, preferably a blend, may be made from soya bean cake, linseed cake, dried grains and cotton cake. Calves suckling, or on the pail, or newly weaned, may be pushed forward by a moderate allowance of linseed cake, bran and crushed maize.

A suitable lamb food may consist of linseed cake or bean meal, crushed maize, dried grains, and rice meal. For ewes in improving condition at tupping time, a little linseed cake and crushed maize, or "tail" oats, would form a suitable addition to the usual pasturage. For horses at farm work the ration may consist of sharps, maize and bean meal, with a little bran in addition if no green forage is available.

Growing pigs and breeding sows will obtain much of the sustenance required from vegetable foods such as clover, vetches, lucerne and rape. Later, waste potatoes will be available for this purpose. All such food may be supplemented by "tail" corn, wheat offals and rice meal. Fattening stores may be fed largely on sharps with the addition of some food rich in albuminoids, such as palm-nut kernel meal or dried yeast.

GROUND NUT CAKE.

THE ground nut, earth nut, monkey nut or pea nut (*Arachis hypogaea*) is grown in most of the tropical and subtropical regions of the world, and to a certain extent in countries where a temperate climate prevails. The chief countries from which ground nuts are exported are, in order of importance, India, Senegal, Gambia, China and Nigeria. A slowly but steadily increasing production has taken place in the tropical parts of the British Empire in recent years. The chief importing countries for ground nuts, in order of importance, before the war, were France, Germany and Holland, and the most important crushing centres, also in order of importance, were Marseilles, Bordeaux, Dunkirk, Hamburg and Delft.

The ground nuts imported into the United Kingdom prior to the war were mainly used either in confectionery (as a cheap substitute for almonds and pistachio nuts) or as edible nuts; on the Continent they are chiefly used as a source of oil and of feeding cake for stock. The nuts are now being crushed on a small scale in the United Kingdom, and ground nut cake of British manufacture will be on the market shortly.

The oil is obtained either by pressing or extraction. The pressing seems to be carried out in three distinct stages: the first (cold) pressing gives an almost colourless oil of pleasant taste and smell which is largely used for table purposes and in the manufacture of margarine; the oil from the second pressing (either cold or warm) is sometimes fit for table purposes, but is mostly used for burning; and that from the third (warm) pressing is a yellowish oil of less pleasant taste and smell, which is used in the manufacture of soap. When the oil is only to be used for the manufacture of soap the whole is usually extracted by chemical means, and as the nuts must then be previously ground, the residue after extraction is in the form of meal.

Only in the case of the very best ground nut cake are the nuts shelled in Europe, and in this case most of the seed-coat is removed in the process. Most of the cake is made from Indian-shelled nuts, in which case only the shell is removed, not the seed-coat and germ. Ground nuts obtained from China and Africa are, as a rule, of much better quality than those exported from India. The last-named, owing to the native practice of wetting them, generally arrive in Europe

in bad condition and yield a dark-coloured cake, much of which can be used only as manure. Efforts are, however, now being made to improve the quality of the Indian exports.

Colour, etc.—Samples of the cake vary in colour from an almost pure white to a grey or grey-brown. The more nearly the colour is pure white, the better is the sample and the smaller is the likelihood of adulteration. (Good cold-pressed cake from decorticated nuts is white or light grey-brown). Yellow or grey-yellow cakes and dark-coloured meals should be suspected of being the produce of nuts mostly spoilt by fermentation and possibly adulterated. Good cake from unspoilt nuts has a sweet, pleasant, bean-like taste, and a fresh, oily smell; the latter, however, is easily lost as the fat has a great tendency to go rancid (some experimenters, however, think that cake with a high fat content keeps better than one with a low). The effect of warm pressing is to give the cake and meal therefrom a red appearance, as the reddish seed coat is then broken up finely, whereas in cold-pressed cakes it is present in large pieces and recognisable as red spots.

Composition.—Analyses of decorticated ground nut cake show that this feeding stuff is very rich in protein. Rufisque cake is usually sold in Germany with a guaranteed minimum of 48 per cent. of crude protein (over 50 per cent. is often found), with 6 to 9 per cent. of fat, about 25 per cent. of carbohydrates, and less than 1 per cent. of sand; while ordinary decorticated samples are usually guaranteed to contain 46 per cent. of crude protein and 7 to 8 per cent. of fat, and they contain in addition up to 9 per cent. of fibre and from 2 to 3 per cent. of sand.

The following analyses are given by various authorities :—

——	Moisture.	Oil.	Crude Protein.	Carbohydrates.	Crude Fibre.	Ash.
Ground Nut Cake :	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Kellner :						
Decorticated..	9·8	9·2	44·5	23·8	5·2	7·5
Rufisque .	9·0	7·0	50·8	24·3	4·4	4·5
Pott :						
Decorticated..	10·00	7·30	48·00	24·50	5·00	5·2
Undecorticated	11·00	9·00	31·00	19·50	23·50	6·0
Voelcker :						
Decorticated..	10·43	8·17	48·32	22·99	4·67	5·42
Undecorticated	11·60	7·17	28·50	28·06	18·97	5·70
Smetham :						
Decorticated..	10·60	7·73	49·31	21·71	4·70	5·95

Digestibility.—As regards digestibility it seems to be accepted that both protein and fat in decorticated ground nut cake are about 90 per cent. digestible on the average; the figure given for the average digestibility of the carbohydrates varies—it has recently* been placed at 93 (Kellner's figure is 84). The following are Kellner's figures for digestible constituents of decorticated cakes compared with those for other foods :—

——	Oil.	Crude Protein.	Carbo-hydrates.
	Per cent.	Per cent.	Per cent.
Ground Nut Cake, decorticated :			
Ordinary	8·30	40·00	20·00
Rufisque	6·30	46·70	20·60
Decorticated Cotton Cake	8·46	35·26	17·42
Undecorticated Cotton Cake	5·11	16·94	17·68
Linseed Cake	9·20	25·80	26·52

According to Voelcker the ash contains 7·62 per cent. of nitrogen, 2·0 per cent. of phosphoric acid and 1·5 per cent. of potash. The residual manurial value is high : adopting Hall and Voelcker's scale, the value works out at 66*s.* 2*d.* per ton if made into dung, and 89*s.* 1*d.* per ton if consumed on the land. These are higher figures than for any other food shown in Hall and Voelcker's Tables. Ground nut cake used in England in the past has at times contained excessive amounts of sand and earthy matters.

Feeding Value.—Decorticated ground nut cake would form a suitable substitute for decorticated cotton cake, and can be used for all classes of stock to add to rations which are poor in protein. If of good quality it is readily eaten by all animals. The best results are obtained from its use when fed in moderate quantities and introduced into the ration gradually, in which case it has no effect on the taste of milk or meat.

For *dairy cows*, up to $3\frac{1}{2}$ lb. per head per day can be recommended; the milk and butter are said to suffer in flavour with larger quantities; with small quantities some experimenters report a favourable effect on the quality of the butter. Ground nut oil was added to the ration of dairy cows in an experiment at Wye College without producing any appreciable difference in the yield of milk or percentage of fat. From 2 to 4 oz. per head per day improved the flavour of winter butter, but larger quantities made the cream difficult to churn and the butter was soft in texture.

* *Illustriertes Landwirtschafts Lexicon*, 1910.

Fattening cattle may be given up to 4½ lb. per head per day; and fattening calves may receive up to 1½ lb. per head per day. Excellent results have been obtained in the Bremen district by feeding calves with a gruel made up with decorticated ground nut cake, separated milk and warm water. Experiments at Woburn in 1892 with fattening bullocks showed that the cake could replace beans in a mixed diet and give as satisfactory results.

Pigs may be given up to 2 lb. per head per day, and a firm bacon of good quality is said to result from the feeding. Care must be taken to begin with very small quantities.

It would probably be best not to give *sheep* more than from ½ lb. to 1 lb. per head per day.

For *horses* ground nut cake seems to have been found specially suitable, and numerous experiments have been made in which this food has satisfactorily replaced part of the oats ration for horses. Thus in a ration of 12 lb. of oats 4 lb. of the oats might be replaced by 2 lb. of ground nut cake, or 6 lb. of the oats by 3 lb. of ground nut cake. In Schleswig Holstein it is usual to begin by replacing 1 lb. of oats by ½ lb. of ground nut meal, and gradually increase this amount. It has further been used in many cavalry regiments in the German army with good results. If the cake is given to horses it is best fed crushed, and either spread out dry over their other foods or mixed with the latter.

Ground nut cake sometimes causes constipation; where this is found to be the case it could be remedied by regulating the other foods in the ration.

Possible Danger from Feeding Ground Nut Cake.—While the high protein content is largely responsible for the high feeding value of the cake it is also a source of danger, favouring the production of harmful decomposition products, though this can, as a rule, only occur when nuts in bad condition are used for making the cake. In a case of poisoning of cows investigated at the Kiel Veterinary Institute the cause was found to be the presence of these decomposition products of the protein of earth nut cake. Decomposition is liable to set in where the nuts have been shelled before transport, but where it does occur it is almost entirely confined to Indian nuts and is due to the wetting of the nuts before they are shipped. Faulty storage of the cake or meal is also likely to cause decomposition. Pott insists that decorticated cakes of which the protein content falls below 47 per cent. should

a priori be regarded with suspicion as being spoilt or coming from spoilt nuts; and that suspicion should increase when the cake contains relatively much amide nitrogen and little sugar.*

Besides the protein decomposition products, cakes may contain rancid fat, decomposed starch, alkaloids, mould organisms and insect larvæ. There have been many instances of animals steadily refusing ground nut cake even though it appeared clean and unspoilt, and this may have been due to one or other of the factors mentioned. If the cakes have a rancid, bitter, or sharp taste they should certainly not be fed to animals; and if there is any doubt on the point they should be cooked and fed to fattening and draught animals, and not to dairy cows, breeding animals and young animals.

Adulteration of the cakes and meals has been practised in the past, and inferior samples may be due to this cause. Both undecorticated cake and meal are more easily adulterated than decorticated cake, but the two former seem to be disappearing from the oil cake trade.

Numerous instances have occurred in which illness has been caused in animals owing to samples of decorticated cake containing castor oil seeds.† These seeds may be present in consignments of nuts sent to Europe, but their presence is also possibly due to the cake being pressed on the same machines as castor oil seeds without the residues of the latter having been removed. A serious case of poisoning from this cause was reported in France in 1913,§ in which five cows aborted and one died through feeding on earth nut cake of the kind commonly used in France. A guarantee should be obtained from the vendor as to the absence of castor oil seeds from the cake.

Besides the possibility of spoilt and adulterated cakes, a third source of trouble in the past has been the presence of hairs on the cakes from the pressing cloths, though these hairs are usually easily visible on the outside of the cake.

Broken ground nut husks are frequently used to adulterate cakes and meals. The husks are also occasionally ground, mixed with molasses and used as a cattle food. The product

* Spoilt cakes were found to contain from 1·2 to 5·3 per cent. of sugar (reckoned on fat free organic matter); normal cakes from 6·2 to 9·1 per cent. Spoilt cakes contained from 0·3 to 0·5 per cent. of amide nitrogen; normal cakes not over 0·34 per cent. Spoilt cakes showed an average fat acidity of 75·3 per cent.; normal cakes 28·4 per cent. (*Bull. de l'Agric.*, 1906, No. 7).

† For a statement on the inclusion of castor oil seeds in cakes, see p. 359.

§ *Bull. Soc. Nat. d'Agri.*, 1913.

known in Germany as "ground nut bran" is generally a mixture of ground nut seed coats and husks.

Damaged and mouldy ground nut cake is used as a manure.

A leaflet giving statistical and commercial information regarding ground nuts can be obtained free on application to the Imperial Institute, and an article giving detailed information as to the cultivation, preparation, and uses of the nut will be found in the *Bulletin of the Imperial Institute* 1910, Vol. 8, No. 2 (London: Eyre and Spottiswoode, 1s. 2d. post free).

THE FAILURE OF A CROP OF BARLEY.

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THE following report is a record of the causes of failure of a crop of barley which were investigated by the writer as Agricultural Adviser of the Cambridge School of Agriculture.

Preliminary.—A letter was received from a Norfolk farmer stating that seed barley which he had purchased and sown on the greater part of a 20-acre field had failed to germinate, whilst home-grown barley, planted on the remainder of the field, had produced a satisfactory plant.

Enquiry from the grower of the purchased seed, who farmed in another part of Norfolk, showed that seed from the same sample had been sown upon three fields on the grower's farm and on several of his neighbours' fields with excellent results, and, further, that another portion of this sample had been sown upon a farm near the scene of the failure, and had produced a very good plant.

The affected barley field was examined on 11th May, when the following observations were made:—

Soil.—The soil upon which the barley was sown is a poor and very light blowing sand (called Breck Land in Norfolk), and is typical of a considerable breadth of land in Norfolk and Suffolk.

Previous Cropping and Treatment.—In 1914 this field had been cropped with mangolds, and as a result of the thorough cultivation of this crop the soil was left very loose in texture. The field had been ploughed during the winter, and after harrowing to produce a tilth the field had been seeded with the barley in March. At the time of seeding the soil was

very loose, and the coulters of the drill sank deeply into the soil in places.

The Seed.—The seed was described by the foreman as being a very good sample in appearance, and before planting it had been dressed in order to protect it from damage by game, which in this part of the country are very numerous. Only 8 pecks per acre were drilled in place of the customary 10 pecks because it was desired to make the seed run as far as possible. The same quantity of home-grown seed had been sown upon the remainder of the field.

Germination.—Enquiry elicited the facts that both the purchased and the home-grown seed germinated very slowly owing to cold and inclement weather, that the home-grown was always much the better plant, and that the purchased seed was always very thin, and rapidly lost plant after it was through the ground. In consequence of this the part originally sown with purchased seed was re-sown in April.

The Crop.—On 11th May the part of the field cropped with home-grown seed presented a uniform but very thin crop. The part cropped with purchased seed was a complete failure, only a few scattered plants remaining, though the second sowing had since germinated and produced a good plant.

Depth of Seed.—A number of plants and germinated seeds were dug up in various parts of the field. It was noticed that whilst the barley sown at the second sowing, in April, was buried at a uniform depth of 1 in. to 1½ in., the first-sown barley was very deeply sown and very irregular in depth, some seeds being found as low as 4 in. in the soil. It was further noticed that without exception all the grains dug up from the first sowing had germinated (a fact easily detected by the roots attached to the grain—see Nos. 1, 2 and 3 in the illustration), but in the vast majority of cases the primary stem had been eaten through by wireworms, a number of which were present in the soil. Of the plants which had survived, the greater part were from seeds which had been fortunate enough to be buried at a shallow depth.

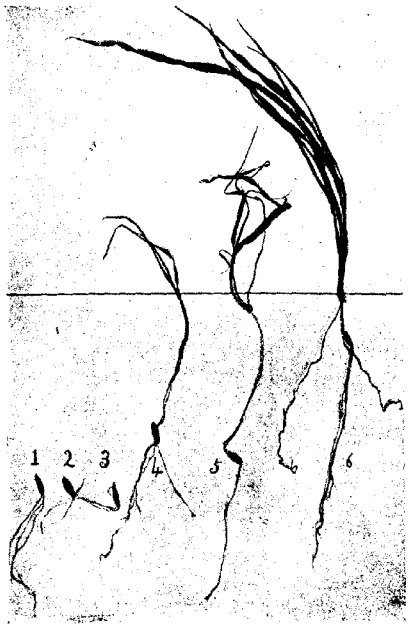
Later in the day, by the courtesy of a neighbouring farmer, the writer was enabled to see another field sown with barley from the identical sample which had failed on the first field. This field, which had been sown at the same time of year on similar land to that bearing the affected crop, and on the same tilth, namely after mangolds, presented an almost perfect seeding. There were, however, three conditions which varied from the first field.

These were :—(1) 10 pecks of seed per acre were sown instead of 8 pecks ;

(2) The soil was consolidated by rolling before seeding ; and consequently,

(3) The seed was sown to a uniform depth of from 2 to 2½ in.

In the illustration below, Nos. 1, 2 and 3 are seeds sown 3 in. to 4 in. deep, which have germinated and have then been eaten by wireworms ; Nos. 4 and 5 are plants which have grown from seeds sown 3 in. to 4 in. deep and have produced weakly plants ; No. 6 is a healthy and vigorous plant grown from seed sown only 1½ in. deep.



Conclusions.

From the facts already stated, it is obvious that no one factor can be given as the sole cause of the failure of the first barley crop. On the contrary, it would seem that a number of causes each contributed its share to the weakening and final destruction of the barley plants. These causes are as follows :—

(i.) *Vitality of the Seed.*—It is obvious that, since the same

sample of seed has on several other fields produced satisfactory results, no great fault can be found with the seed; nevertheless, if the foreman's statement is correct that no more seed was sown on that part of the field cropped with the home-grown seed, then it is clear that the vitality or vigour of the home-grown seed was greater than that of the purchased sample.

(ii.) *Dressing of the Seed.*—The dressing of the seed with a tarry preparation for the purpose of keeping away birds, good practice though it is, does tend to retard germination to a very slight extent, as the writer has tested experimentally.

(iii.) *Weather.*—The weather following seeding was cold and not favourable to quick germination.

(iv.) *Looseness of the Seed-Bed.*—This factor contributed in no small way to the failure, since it was owing to this that the first seeding was buried so deeply in the soil; as a consequence of this (1) a very large portion of the reserve food stored in the barley grain had to be used up in forming the long primary stem necessary to reach the surface of the soil (see No. 5 in the illustration), and (2) the wireworms were enabled to move freely through the soil.

The looseness of the seed-bed can be easily overcome by thorough harrowing and rolling before the seed is sown, a practice which was adopted by the successful grower on similar land. On such light land, the importance of consolidating the soil immediately below the surface cannot be too strongly emphasised, not only for the sake of uniformity in depth of seeding, but also for the sake of forming a good foothold for the roots and supplying them with moisture.

(v.) *Wireworm.*—The three causes already mentioned had each helped to weaken and delay germination, consequently the wireworm in this open soil had an easy opportunity of killing the barley.

(vi.) *Quantity of Seed.*—The reduction in the quantity of seed sown, from the normal of 10 pecks to 8 pecks, was a very important factor in the failure. Wireworms do not damage the plants in proportion to the number of seeds sown. On the contrary the damage done by them is always most serious in a thinly-planted field, It is, therefore, quite conceivable, that had 10 pecks been originally sown, sufficient would have been left to have produced a successful crop.

It should be remembered that the secondary roots upon which the plant depends for its sustenance, are alway formed near the surface, hence deep sowing does not, as is so often supposed, necessarily encourage deep rooting or drought resistance.

THE HITCHIN BACON FACTORY.

J. W. WELSH.

THE Hitchin Bacon Factory owes its origin to a movement started by a number of farmers living in the neighbourhood of Bedford. These farmers considered that, as the dealers formed a kind of "ring," they did not receive the value for their pigs when sold in the local market that they might reasonably have expected if there had been free competition. After giving the matter some consideration a party of the most energetic and influential of the farmers paid a visit to Roscrea and other large bacon-curing establishments in the South of Ireland, and also to some of the English factories. In due course the farmers interested formed a committee. A promise was received that, if the farmers would subscribe £5,000 among themselves, arrangements would be made to supply any further capital required. The necessary amount was subscribed by some 220 farmers. At this stage, however, the Bedford members became less enthusiastic in their support of the project, and it was decided by some of the most enterprising of the Hitchin members to establish the factory in their own district. The building was accordingly erected at Hitchin and formally opened there on April 13th, 1913.

In the erection of the Hitchin factory the aim has been to combine simplicity of construction and ease of supervision with a liberal supply of light and good ventilation. Full effect has been given to this aim, and it may fairly be claimed that the factory is the finest of its kind in the country.

The factory is built of brick, laid throughout in cement. The main building has a frontage of red brick of 181 feet, a depth of 139 feet, and a height of 30 feet 6 inches. The engine-room and pig pens are behind and outside the main building, and the total length of the building is 257 feet.

The killing and curing operations are carried out on the ground floor, the curing rooms being strongly insulated against outside temperature. The temperature of the chilling and curing rooms is maintained at 38° F. and 42° F., respectively, by the use of a 6-ton refrigerator plant.

In the following notes an attempt is made to give an impression of the routine work of the factory:—

Purchase of Pigs—A postcard giving the price of pigs for the following week is posted every Saturday to all the known pig keepers within a radius of 50 to 70 miles of the factory. Pig keepers are invited to send their pigs either by rail or by cart

on Mondays, Tuesdays, Wednesdays or Thursdays. When pigs are sent by rail the factory pays carriage on 10 pigs or over up to 100 miles, but if the farmer carts the pigs himself he has to deliver them free.

As the shareholders have not been able to supply the requisite numbers of animals, a proportion of the pigs are bought from pig keepers who are not shareholders and, when necessary, from dealers.

All pigs bought are paid for by dead weight, the factory paying for the whole carcass with the exception of the intestines and pluck.

Treatment in Factory.—After the pigs have been delivered they are put into numbered pens, and each lot is earmarked with a number. This number is communicated to the owner to enable him to distinguish his own pigs if he comes to see them weighed.

The pigs are held over for one night to allow them to rest and empty their stomachs as much as possible, and are killed the following morning.

From the commencement all pigs have been killed with the R.S.P.C.A. humane killer, or captive bolt pistol, which has proved very efficient, and although adding to the cost of the killing it is considered a great advance on the old and less humane system of bleeding to death. After the pigs have been shot they are hoisted by a shackle attached to the hind leg, which is hooked to an endless chain. The pigs are carried along by the chain and deposited on a running rail which conveys them to the bleeding passage. They are there bled, the blood running into a tank, where it is dried each day and eventually used as manure. The carcass is then conveyed to the scalding tank where it is scalded at a temperature of 150° F. At this stage the hair is scraped from the carcass, collected and dried, and afterwards sold for stuffing saddlery, etc.

The pig is then drawn on the running rail to the singeing furnace. This consists of a cylinder containing a number of gas jets, through which mixed air and gas are forced with a powerful fan, thereby forming a series of strong Bunsen burners which give off an intense heat.

The pig is subjected to the heat of this furnace for 30 to 40 seconds. The heat exerts a contracting influence on the skin, effacing wrinkles, and giving the carcass a plumper appearance. It also imparts the nutty flavour peculiar to the Wiltshire style of curing. After leaving the furnace the pig is lowered into a cold bath and cooled off, and any burnt skin is removed. The pig is then opened up and disembowelled near a table

Fig. 1.—Hanging Floor. Length 139 ft. Showing 120 carcasses of pigs killed the day before the photograph was taken.

Fig. 2.—Sausage, Pie-making, and Lard Refining Departments. Length 139 ft., width 35 ft.

at which a number of women are ready to clean the intestines and similar organs. Parts of the intestines, when prepared, are used for sausage casings, the stomach and other parts for chitterlings, the fat is rendered for dripping, and the bladder filled with lard.

When the dressing has been completed the carcasses are conveyed to the weighing scales. Weighing takes place at 12 o'clock noon, and the owners of pigs are invited to be present and see their own pigs weighed. A beam-scale is provided for the weighing. This picks the carcass off the rail, weighs it, and replaces it on the rail.

All pigs are bought by the score of lb., so that the farmers can check the weights with greater ease. The weights used are 50 lb., 20 lb., 10 lb., 5 lb., and a number of smaller weights. After the pigs are checked and weighed the carcasses are split into halves, the back bones and flake lard are taken out, and the heads are cut off. The sides are then put in the chilling-room, at a temperature of 38° F., until the following morning, when they are trimmed up by having the blade bone extracted, part of the ham bone taken out, and the loin steaks, skirts, and any other ragged pieces removed. After having once more been placed in the chill room for 24 hours the loin steaks are sent to the pie department, and the skirts and trimmings to the sausage room for making saveloys, polonies, etc.

After the sides have been chilled for from 36 to 40 hours they are dry-salted. The first part of the process is to inject a pickle of salt and saltpetre (no other chemicals are used) by the aid of a pump. To ensure uniformity in curing, the pickle is first injected into the thick parts, *i.e.*, fore-end and gammon. The sides are then piled on top of each other, 10 sides high, in the curing room, at a temperature of from 40° F. to 44° F. As each side is placed on the top of the one below, it is lightly dusted with fine saltpetre and a thin layer of curing salt. The sides are left in the pile for nine or ten days, according to their weight. At the end of this period they are taken from the pile and the pickle is drained off, after which they are again piled up, this time with the skin uppermost, to drain, dry, and mature for another ten days. The sides are then ready for use as green bacon, or for smoking.

If smoked bacon is required, the sides are washed and dusted over with pea flour, hung in the smoke houses and smoked and dried with hard wood sawdust for from three to four days, according to the weather. In wet weather the drying takes longer. The heads are used for making brawn, and the chaps and feet find a ready market.

The pie product department of a bacon factory is an important one. In the Hitchin factory heavy fat sows and pigs are largely killed for making sausages, pies, brawn, galantines, polonies, saveloys, faggots, etc. The whole carcass is used for the purpose, and in this way a profitable outlet is found for this class of pig.

Lard making is also a considerable industry. As soon as the flake is taken from the pig it is cooled off, and then put through a crushing machine to crush up the small globules and release the liquid fat more easily. The fat falls from the crushing machine into a small jacketed pan where it is melted and boiled to evaporate any natural moisture. After this it is run into a settling pan where it is allowed to stand for about six hours to allow any fibrous particles to settle to the bottom of the pan. It is then pumped into an agitator—a jacketed vessel with revolving paddles—where it is beaten up to get texture. It is then drawn off while in a semi-liquid state into the different types of packages in which it is to be stored, *e.g.*, bladders, parchment bags, tins, etc.

Type of Pig Required.—One of the first difficulties encountered in establishing new bacon factories is to obtain locally pigs which produce bacon suited to the public taste. The pig required for a Wiltshire side should have a small shoulder (as this is the coarsest part, and in retailing realises the least money), a good deep middle, with a good loin and a good ham, and not too great a thickness of fat on the back. Top prices are usually paid for pigs weighing from 120 to 190 lb. dead weight.

The Large White most nearly fulfils these requirements, although some strains of this breed have to be fed over the weight quoted to get them properly finished. Some strains of Middle White also make very useful pigs, but one of the best bacon pigs is obtained by crossing a Large Black sow with a Large White boar, although almost any good sow will produce a good bacon pig when put to a pure-bred Large White boar.

Support of Farmers.—Unfortunately the success of the factory as a co-operative institution has been somewhat impaired by the failure of the members to support it loyally. The farmers show a marked disinclination to bind themselves to send all their pigs to the factory, and still often sell to local dealers whenever the price offered is higher than that offered by the factory. They fail to realise that their loyal support would increase the dividends and apparently forget that they have invested their capital in the factory. It should be pointed out, moreover, that

the competition of the factory has been instrumental in raising the local prices by from 5 to 7½ per cent., and that were this competition withdrawn, owing to the failure of the factory, the prices obtained might be considerably less than they now are.

Some difficulty has also been experienced in the endeavour to induce the members to study the requirements of the factory in breeding the right type of pig, and in feeding to produce the best bacon.

Results Obtained by the Factory.—The factory commenced working at a rather unfortunate time. The price of pigs was at first abnormally high, and with a run of falling markets a considerable sum of money was lost during the first 10 months' trading. During the following six months, however, matters greatly improved, and after paying all charges this period showed a satisfactory profit. The sum of £42,486 was spent in the purchase of pigs in the first 10 months, while the total amount thus expended during the first full year's working was £59,415.

The speed with which the factory established itself is well shown by the fact that in the fifth month of its existence the goods sold amounted to £7,225 16*s.* 8*d.* The winning of the Empire Trophy at the Dairy Show has undoubtedly stimulated the growth of business. The Company has also since taken 1st, 2nd, and 3rd prizes at the Royal Agricultural Show at Shrewsbury.

Capital Required.—As other co-operative bacon factories are likely to be established in other parts of the country in the course of the next few years it may be of interest to give the experience of the Hitchin factory as regards the raising of the necessary capital and the cost of working. It was found impossible to raise in the district itself more than about half the capital required, or only sufficient to build the factory. To finance the trading part of the business, capital had to be borrowed from other sources. A large amount of trading capital is required to tide over the business until the first returns come in. The processes of curing and smoking take from three to four weeks, and a further period of six weeks must be allowed before payment can be obtained from the retailer. As it is the practice to pay the farmer in cash it will be seen, therefore, that to deal with 300 pigs a week costing, say, on an average, £4 each, a working capital of about £12,000 will be required. To start a modern bacon factory on even a moderate scale it will be necessary to raise at least £20,000.

NOTES ON FEEDING STUFFS IN JULY.

From the Animal Nutrition Institute, Cambridge University.

THE feeding stuffs included in the following notes are the same as those mentioned in former notes,* and the method of calculation is the same as that already described. The large table, p. 323, gives the price per ton and per food unit† of about 30 feeding stuffs at London, Liverpool, Hull and Bristol on 28th June. These feeding stuffs are arranged in the list, p. 324, in order of the average price per food unit at the four markets.

As before, there is a certain amount of variation in the price of certain articles at the different markets, due no doubt to varying cost of transport from the centre of production or the port of landing. This variation, however, is not in most cases so great as to invalidate the average figures. The figures as a whole show that prices have fallen slightly, and this fall is specially noteworthy in wheat offals, which have no doubt been influenced by the fall in the price of wheat. Undecorticated cotton cake, both Egyptian and Bombay, is one of the few foods which have risen in price. It is now appreciably dearer per food unit than linseed cake, and at present prices it is not an economical food to buy. Maize and its products and rice meal are cheaper than last month. Oats and barley are still far too dear to use except in case of necessity.

Suggestions for Rations in July.

For Farm Horses at Work.—At this time of year work is often slack, and the horses are allowed to graze with little or no added dry food. This is not a good preparation for the hard work of the harvest. It will usually pay to give them some such ration as that suggested last month.

For Milking Cows.—Heavy milkers are very liable to fall off in their yield of milk towards the end of July or the beginning of August, especially when drought has cut short the supply of grass, as is the case this year. To prevent this they should be given a liberal supply of green stuff from the arable land where this is available. Otherwise they should be given in their mangers a mixture of two parts maize gluten feed, one part linseed cake and one part rice meal. Four or five

* This *Journal*, March, 1915, p. 1111; April, 1915, p. 52; May, 1915, p. 148, and June 1915, p. 248.

† This *Journal*, May, 1915, p. 148.

Feeding Stuff.	Reckoned from digestible nutrients.		Approximate prices per ton at the beginning of July.								Approximate prices per Food Unit.			
	Nutritive Ratio.	Food Units.	London.	Liverpool.	Hull.	Bristol.	London.	Liverpool.	Hull.	Bristol.
			£ s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	s. d.	s. d.	s. d.
Soya Bean Cake	1 : 1·1	122·3	8 0 0	8 7 6	8 2 6	8 2 6	1 3¾	1 4½	1 4	1 4
Decorticated Cotton Cake	1 : 1·3	126·3	9 0 0	10 5 0	—	9 15 0	1 5	1 7¼	—	1 6½
Indian Linseed Cake	1 : 1·9	123·1	—	9 15 0	9 15 0	—	—	1 7	1 7	—
English Linseed Cake	1 : 2·0	120·1	10 7 6	10 15 0	9 15 0	10 7 6	1 8¾	1 9½	1 7¼	1 8¾
Bombay Cotton Cake	1 : 2·4	65·3	—	6 15 0	6 12 6	6 17 6	—	2 1	2 0½	2 1½
Egyptian Cotton Cake	1 : 2·6	71·9	6 12 6	7 10 0	6 17 6	7 2 6	1 10¼	2 1	1 11	2 0
Coconut Cake	1 : 3·8	102·6	6 17 6	—	—	8 0 0	1 4	—	—	1 6¾
Palm-nut Kernel Cake	1 : 4·0	83·5	5 13 9	5 5 0	—	7 0 0	1 4½	1 3	—	1 8¼
English Beans (New Spring)	1 : 2·6	99·5	9 0 0	10 10 0	9 11 0	9 9 6	1 9½	2 1½	1 11½	1 10¾
English Beans (Old Spring)			9 10 0				1 11			
English Beans (Old Tick)			10 10 0				2 1½			
Chinese Beans	1 : 2·6	101·2	9 15 0	10 10 0	9 6 6	—	1 11½	2 1	1 10	—
English Maple Peas	1 : 3·2	97·2	11 2 0	—	10 0 0	—	2 3½	—	2 0¾	—
English Dun Peas	1 : 3·2	97·2	10 0 0	—	9 16 0	—	2 0½	—	2 0¼	—
Calcutta White Peas	1 : 2·3	97·5	13 6 6	14 0 0	—	—	2 8½	2 10½	—	—
American Maize	1 : 11	93·8	8 3 6	8 17 6	—	—	1 9	1 10¾	—	—
Argentine Maize	1 : 11	94·2	7 9 6	8 13 6	7 14 0	8 3 6	1 7	1 10½	1 7½	1 9
					8 0 0				1 8¼	
Maize Meal	1 : 13	86·5	8 10 0	8 10 0	9 2 6	8 5 0	1 11½	1 11½	2 1¼	1 11
Maize Gluten Feed	1 : 3·3	121·6	8 0 0	—	—	8 7 6	1 4	—	—	1 4½
Maize Germ Meal	1 : 8·4	99·2	8 3 9	9 0 0	8 17 6	8 10 0	1 8	1 9¾	1 9½	1 8½
English Feeding Barley	1 : 7·8	83·0	10 1 6	10 5 6	9 16 0	9 16 0	2 5½	2 5¾	2 4½	2 4¼
English Oats	1 : 7·9	75·4	12 0 0	11 16 6	11 0 0	12 0 0	3 2½	3 1½	2 11½	3 2¼
Argentine Oats (Buenos Ayres)	1 : 7·9	75·4	9 19 0	10 11 6	10 13 6	10 6 6	2 8	2 9¾	2 10¼	2 9
Argentine Oats (Bahia Blanca)	1 : 7·9	75·4	10 6 6				2 9			
Malt Culms (London)	1 : 3·6	69·9	5 15 0	6 7 6	5 0 0	6 0 0	1 8	1 10	1 5¼	1 8¾
Malt Culms (Burton mixed)			5 3 9				1 5¾			
Brewers' Grains (dried)	1 : 3·4	84·5	5 16 3	—	6 10 0	6 10 0	1 4½	—	1 6½	1 6½
			*5 18 9				1 5			
Brewers' Grains (wet) mixed	1 : 3·4	21·1	14 6	—	1 4 0	—	0 8½	—	1 1¾	—
Brewers' Grains (wet) finest ale			16 0				0 9			
Egyptian Rice Meal	1 : 10·3	78·7	—	—	—	—	—	—	—	—
Burmese Rice Meal	1 : 10·3	78·7	6 5 0	6 10 0	—	7 5 0	1 7	1 8	—	1 10
Wheat Middlings	1 : 5·3	93·4	7 7 6	—	7 5 0	—	1 7	—	—	—
Wheat Sharps	1 : 5·3	86·3	7 5 0	8 7 6	8 5 0	7 15 0	1 8¼	1 11½	1 11	1 9½
Wheat Pollards	1 : 5·3	81·9	—	6 0 0	—	—	—	1 5¾	—	—
Wheat Bran	1 : 5·3	77·5	5 15 0	5 17 6	6 0 0	5 12 6	1 6	1 6	1 6¼	1 5½
Wheat Bran (broad)	1 : 4·7	79·9	6 17 6	6 10 0	7 5 0	6 2 6	1 8¾	1 7½	1 10	1 6¾

* Fine Ale Grains.

pounds of this mixture per head per day is the ration for a cow yielding 2½ to 3 gals. of milk per day. This must be increased for cows giving higher yields. Another mixture which may be used for the same purpose is equal quantities of linseed cake and pollards. These mixtures must be given in the manger. They are liable to get wet and pasty if put in tubs in the field, in which case the cows do not eat them readily. For use in tubs in the field, equal quantities of linseed cake and coconut cake may be used. Cows do not take to coconut cake at first, so it should be introduced gradually, the first few days a very little being added to the linseed cake, and the proportion increased until it is half and half. Given in this way cows eat it well. At present prices it is a cheap food and suitable for milking cows.

Average Prices per Food Unit at the Four Markets of the 30 Feeding Stuffs, shown on page 323.

	s.	d.	
Brewers' grains (wet)	0	11⅛	per food unit.
Soya bean cake	1	4	,, ,,
Maize gluten feed	1	4¼	,, ,,
Palm-nut kernel cake	1	5¼	,, ,,
Coconut cake	1	5½	,, ,,
Wheat pollards	1	5½	,, ,,
Brewers' grains (dried)	1	6	,, ,,
Wheat bran	1	6	,, ,,
Decorticated cotton cake	1	6¼	,, ,,
Wheat middlings	1	6¾	,, ,,
Linseed cake, Indian	1	7	,, ,,
Malt culms	1	8	,, ,,
Wheat bran (broad)	1	8	,, ,,
Rice meal, Burmese	1	8¼	,, ,,
Maize, Argentine	1	8¼	,, ,,
Linseed cake, English	1	8¾	,, ,,
Maize germ meal	1	9	,, ,,
Wheat Sharps	1	9½	,, ,,
Maize, American	1	9¾	,, ,,
Beans, Chinese	1	11¼	,, ,,
Beans, English	1	11½	,, ,,
Cotton cake, Egyptian	1	11⅝	,, ,,
Maize meal	1	11¾	,, ,,
Peas, English dun	2	0½	,, ,,
Cotton cake, Bombay	2	0¾	,, ,,
Maple peas, English	2	2	,, ,,
Feeding barley, English	2	5	,, ,,
Oats, Argentine	2	9	,, ,,
White peas, Calcutta	2	9½	,, ,,
Oats, English	3	1¼	,, ,,

For Baby Beef at Grass.—At the present price of beef it is desirable to bring on young stock intended for baby beef as quickly as possible, and liberal feeding is desirable. The follow-

ing ration is recommended, which is suitable for young stock about 4 months old, and should be gradually increased to double this amount by the time they are 10 months old :—

1 lb. linseed cake,
1 ,, bran,
1 ,, crushed maize,

To be given dry with about a pound of hay chop.

For Heifer Calves and Store Steers at Grass.—Where grass is short the following ration may be used :—

½ lb. linseed cake,
1 ,, bran,
1 ,, dried grains,

To be given dry mixed with about a pound of hay chop.

For Lambs to come out as Mutton in the Autumn.—The following mixture is suitable for lambs on tares or clover aftermath :—equal quantities of linseed cake, dried grains, rice meal and crushed maize. The ration should vary from ¼ lb. to 1 lb. per head per day, according to the age and weight of the lambs.

For lambs on cabbage, early turnips, rape or mustard the mixture should be equal quantities of linseed cake, dried grains, rice meal and bean meal, and the ration should vary as before with the size of the lambs.

For Pigs.—Stores 7 months old and over to come out in the autumn as large pork pigs (cutters) :—

A mixture of 7 parts of sharps and 1 part of linseed cake ; ration according to age and weight. The linseed cake should be broken fine and not added to the slop until immediately before feeding. Some samples of linseed cake are liable to develop poisons if kept wet and warm for any considerable time, for instance, two or three hours.

Other pigs as in former notes.

COMBINATION IN POULTRY KEEPING.

EDWARD BROWN, F.L.S.

THE smaller a holding the greater, *pro rata*, is the number of poultry usually kept. That is true in England and Wales as in all other countries. Table 12 of the Poultry Census of 1908 reveals the variations, which are very suggestive. For agricultural holdings exceeding 1 acre in Great Britain (England and Wales were not separately enumerated in that report) the fact is stated in a striking manner. This table includes both old and young birds. The following are the total numbers of fowls (excluding ducks, geese and turkeys) :—

Holdings above 1 acre and not exceeding				5	acres	940	fowls	per	100 acres.
,,	,,	5	acres	,,	,, 50 ,,	244	,,	,,	
,,	,,	50	,,	,,	,, 300 ,,	77	,,	,,	
,,	,,	300	,,	..	.. .. ..	37	,,	,,	
				Total	.. .. ..	100	,,	,,	

Out of each 100 fowls recorded the adults numbered 53 and the young stock 47. It will be seen, therefore, that for every fowl on farms above 300 acres in extent there were 25 on those above 1 acre and not exceeding 5 acres for the same acreage of cultivated land.

The Question of Labour.—To a considerable extent these variations are due to the fact that many of the larger farms are either arable or that they are used for stock rearing. On farms of the former type fowls are not regarded with favour, while on the latter the necessity for regular attention and housing of poultry has hindered increase. Moreover, many areas are comparatively thinly populated, consequently labour is often not available for control and oversight. At the same time much more ought to be done than is now the case though, as a question of economics, it cannot be expected that the same average production of eggs and poultry will ever be attained on large as on small farms.

One of the main difficulties met with by larger farmers who are disposed to develop a poultry branch of their operations is that they are unable to attend to the fowls themselves, and think they cannot find trustworthy men to do so. This is not a question of fixed hours. Hens require to be attended to early and late and often. Poultry-keeping is a personal industry, succeeding best where the operators have a realisable

interest in the financial results. The numbers of poultry kept are, therefore, frequently restricted to the capacity of the farmer's family.

A Method of Co-operation.—A system has been evolved within the last generation in the semi-agricultural, semi-industrial areas of East Lancashire and the West Riding of Yorkshire, though not unknown elsewhere, by which those in occupation of the land and those desirous of keeping fowls act in unison. In these districts the land is chiefly used for milk production or grazing. Many of the farms are moderate in size so that the labour provided by the farmer's family has to be entirely depended upon. In not a few cases delivery of milk and other work does not leave much margin of time. Poultry-keeping has not developed to the extent that might be expected among this class of farmers. On the other hand, artisans residing in the manufacturing villages in those northern valleys have for generations been ardent breeders of poultry. At one time they were mainly fanciers and exhibitors, and their little plots sufficed for their needs. With the growth of utility poultry-breeding more land became imperative for the development of the industry. Provision of allotments has done much to increase the opportunities for keeping poultry, as has also the system of co-operation already referred to, the advantages of which are: (1) that the poultry-keeper does not require to be also a farmer and has no responsibility for cultivation of the land; (2) that he is thus enabled to keep a much larger stock of fowls than would be possible on a small plot, avoiding all danger of tainted soil and minimising risks of disease; (3) that the cost of equipment is much reduced, as wire netting is not required; (4) that the cost of feeding is less as the birds obtain a fair amount of natural food; (5) that the farmer, without assuming responsibility for the birds or labour in management, receives a rent for the use of his land, in addition to which the pastures are benefited by the manure produced.

This system is capable of considerable extension in all pasture areas and to a less extent upon arable lands, not alone where industrial operatives reside but also for farm labourers and other rural residents. Its adoption would largely increase home production, to the benefit of both parties to the arrangement.

How the System Works.—The conditions under which this method is carried out are clearly defined. The farmer gives access to his fields either at all or at stated times, so that the poultry-keeper may attend to his fowls. He imposes a limit

as to the number of birds, and has the right to say when and to where the houses must be moved. Upon pastures such removal is essential. If the fowls were allowed to remain too long in one place the herbage around the houses would be injured or destroyed, and the full benefit of the manure would not be obtained owing to incomplete distribution. On arable fields one corner might be allotted, where the ground would be left bare. This would, however, necessitate a loss of crop, so that it is preferable, and, as a rule, possible to alternate between fields in accordance with the rotation of crops. Cattle can be kept on the same fields as the poultry so long as there is no overstocking.

For this method of poultry-keeping portable houses should always be employed. They ensure that mobility which is essential to successful conduct of the system. The number of birds which can be allowed will vary in accordance with existing conditions. In the case of a labourer engaged upon a farm it might be felt desirable to impose restrictions so that there would be no danger of his neglecting his regular duties. Probably one house with twenty-five hens would be regarded as the limit. In the case of other persons there need be no curtailment in this way. All that has to be considered is the number of fowls that can be maintained on the land without risk of interference with the other operations of the farm. On a pasture field wherein are other stock ten birds to the acre over which they run will be enough. Where the land is laid down for hay as many as twenty-five fowls per acre will not be too many. In that case they would be removed ten weeks before cutting takes place.

It is wise to insist that the poultry-keeper shall hatch and rear chickens upon a plot near his residence, not putting out the birds until they have made sufficient growth to look after themselves, and do not require constant feeding. That is, however, an arrangement which can be left for determination in each individual case. In one instance a cottage was let to the poultry-keeper with an acre of land, upon which all the chickens were reared. The breeding and laying stock and growing chickens were allowed to run on the farm in the manner stated.

Where it is intended to carry out such a system as that advocated by Mr. F. G. Paynter,* the breeding stock could be kept on the open fields to which the poultry-keeper would be allowed

* See this *Journal* for June, 1914, p. 220.

access, while hatching and rearing to the killing stage could be conducted upon an allotment devoted to that purpose, in which case provision would be indispensable for change and cultivation of ground at least once a year. In this way the vigour of the parent stock and, therefore, of the chickens would be maintained.

The method described above is one which opens out a wide field of effort and enterprise for women as well as men, and would give a great stimulus to home production, improving the position of rural workers. A further point is that in many cases it would be a profitable supplement to other sources of income.

The charge usually made for permission to place a house on the land in the manner described, is 6*d.* per bird per annum, or 10*s.* per house yearly with not more than 25 adult fowls or 40 growing chickens, or for the latter 1*s.* per calendar month might be charged. As already stated, the farmer has the benefit of the manure, which for 25 fowls would be equal in fertilising value to 25*s.* to 30*s.* per annum, in accordance with their size and breed. Thus he stands to gain very considerably.

A Belgian Method.—Upon an estate at Lippeloo, in East Flanders, a plan (suspended for the present as a result of war conditions) has been in operation for some years which would possibly be preferred by landowners and larger farmers, so far as their own men are concerned, where they are willing to organise and supervise the operations. A considerable number of pullets are hatched every year. In the autumn about 600 are selected for breeding purposes, and, with the necessary males, are loaned to farmers and cottagers on the estate according to the accommodation available. The birds remain the property of the landlord, who has the right to remove them and replace them the following autumn. Each of the recipients manages the flock committed to him and provides the food at his own expense. All the eggs laid are sent to a centre twice a week. The payments are made at fixed rates, so that the individuals have no responsibility for finding markets. As the birds are at full liberty they find the greater part of their food and are inexpensive to maintain. It is stated that the profits in many instances amount to 6*s.* per hen per annum. The return, however, is largely dependent upon efficient and careful management, which in itself is a stimulus to those undertaking the work. Many an agricultural labourer with the help of his wife, and many older people who

live wholly or partly upon charity, could in this manner make an appreciable addition to their small incomes, if the opportunity were afforded. It is a form of combination or co-operation which would greatly increase the native supplies of eggs and poultry.

Conclusions.—The two methods referred to above are not suited to small farms or holdings, but to the larger farms. It is upon these that the great development of egg and poultry production must take place if the country is to attain its full capacity. In England and Wales 68 per cent. of the land under cultivation is in farms of more than 100 acres. Upon the fruit orchards of the country there is a vast opportunity for extension of poultry-keeping, as these have hitherto been used only to a very limited extent. The system referred to above could be adopted with advantage in many cases. If the power of organisation of these classes of agriculturists were employed to develop the poultry industry on the lines referred to, the nation would be independent of foreign supplies, and the humbler workers would be able to turn their spare time and the labour of their families to profitable use.

EGG PRODUCTION AT MORDEN HALL, 1914-15.*

Introduction.—In view of the fact that at the present time many poultry keepers are reluctant to increase their stock of birds, and in many cases have reduced their normal flocks owing to the enhanced price of feeding stuffs, it may be of interest to give an account of the results obtained from a number of pullets which were raised last year at Morden Hall as table birds, but on the outbreak of war were retained for laying purposes.

Character of Stock.—In August, 1914, there were about 1,200 pullets among the table chickens at Morden Hall, the remainder of the stock being cockerels. As the birds were sold off in weekly batches when they reached the age of 12 to 14 weeks, none of these pullets were hatched prior to 1st May, 1914, and the greater number of them were hatched subsequent to the middle of May. A fairly large proportion were pure-bred birds of the following breeds or varieties:—Light and Speckled Sussex, Faverolles, White Wyandotte, White and Buff Orpington, and Rhode Island Red. In addition, there were some first crosses and a few mongrels.

Although these birds were not in any sense promising for egg production, as they were hatched late in the spring, and were largely of the table or general purposes type, having been reared with a view to the production of flesh, it was felt that they nevertheless constituted the potential source of a very considerable egg supply. In the middle of August, therefore, it was decided to make a selection of the birds and to retain about 1,000 pullets for egg production.

Method of Housing.—The first consideration was the manner in which the birds were to be housed. The laying section was not intended to be a permanent feature of the Morden Hall demonstration, and the object in establishing it temporarily was to meet an emergency. It was, therefore, important to house the birds cheaply. Despite some adverse criticism, Mr. Paynter decided to use Sussex arks for the pullets, each ark costing 27*s.* 6*d.*, and accommodating 25 birds. Separate nest boxes were provided which were placed beside the arks. The runs averaged 30 yd. by 9 yd., and were erected on a

* An account of the Chicken Rearing Demonstration at Morden Hall in 1913–14 was given in this *Journal* for April, 1915, p. 10.

fresh piece of light, dry grass land, where a certain amount of protection from wind was afforded by a hedge.

The runs were constructed of wire netting and chestnut or hazel posts, which cost about ¾*d.* each. They were arranged on the four sides of a rough rectangle with paths which gave facilities for feeding and the collection of eggs. No gates were used, and access was gained to the runs by placing one movable post, which was loosely fixed in the ground, next to a fixed post and attached to it at the top by a stout wire ring which could be slipped over the top of the post at will. When the ring was removed an entrance was obtained between the two posts. The forty runs necessary to accommodate the pullets were erected by Mr. Paynter and an assistant without any further help, and they were completed for the reception of the pullets early in October, 1914. The arks were placed in them, and in order to prevent the ground below the house becoming foul, and to preserve part of the manure, a board with slightly sloping sides was fitted below the slatted bottom of each ark.

The total cost of providing 40 houses, nest boxes, dropping boards, water and grit pans, food tins and the wire netting and posts, including sundries, amounted to about £120 11*s.* 4*d.* The cost of housing was, therefore, about 2*s.* 5*d.* per bird.

One thousand and sixteen pullets were selected, and the laying stock was divided into flocks of 25, each of which was placed in a separate run. Of the pullets originally selected 61 were subsequently killed for consumption, and a few deaths occurred from ovarian troubles during the period up to 31st May, so that at that time there were about 950 birds in the runs.

Method of Feeding.—The birds were fed in the morning with a mash prepared as follows :—

Meat Meal	1 lb.
Biscuit Meal	1 lb. 10 oz.
Bran	1 lb. 10 oz.

mixed with 1½ gal. of boiling water and dried off with 8 lb. of sharps.

In the evening they received a grain mixture made up as follows :—

Wheat	2 parts.
Maize	1 part.
Oats	1 part.

They were supplied with ample quantities of grit and oyster shell, and with clean water. No green food other than that obtainable on the runs was given to the birds.

The eggs were collected mainly in the afternoon, but additional collections were made as the yield increased.

The houses and nest boxes were regularly cleaned and the runs were occasionally swept, but the management, while systematic and careful, did not provide for any coddling.

Marketing.—The eggs were weighed and counted, and any exceptionally small or ill-formed specimens were removed, the remainder being despatched to London and sold on commission through a large wholesale firm. The eggs were always despatched *within* 24 *hours* of the date of laying.

Approximate Financial Result after 8 *Months' Work.*—The following table gives a statement of the results which were obtained up to 31st May, 1915:—

Morden Hall Egg-laying Demonstration, 1914–1915.

Month.	No. of Eggs marketed.	Cost of Pullets' Food. (Approx.)	Gross Proceeds of Sales. (Approx.)	Railway Charges and Commission. (Approx.)	Net Proceeds of Sales. (Approx.)
		£ s. d.	£ s. d.	£ s. d.	£ s. d.
1914.					
October ..	1,131	35 0 0	7 11 0	---	7 11 0
November ..	2,138	30 17 2	19 1 0	16 5	18 4 7
December ..	5,230	31 13 1	48 7 11	3 0 11	45 1 0
1915.					
January ..	9,360	32 13 10	72 4 3	6 0 8	66 3 7
February ..	10,365	32 18 5	72 0 7	6 9 0	65 11 7
March ..	15,443	42 13 6	82 5 11	7 19 10	74 6 1
April	14,736	40 16 9	73 6 4	7 11 7	65 14 9
May	12,304	37 19 6	64 11 0	6 13 10	57 17 2
Totals ..	70,797	281 12 3	439 8 0	38 18 3	400 9 9

Consideration of the Returns.—Taking the average number of pullets on the runs during the period as 1,000 it will be seen that the egg yield from 1st October, 1914, to 31st May, 1915, was over 70 eggs per bird, and the average gross price received for the eggs was approximately 1*s.* 6*d.* per dozen, while the cost of food per pullet during the period was 5*s.* 8¼*d.* Each pullet, therefore, cost 2*s.* 5*d.* to house and 5*s.* 8¼*d.* to feed, and produced in eggs a gross amount of 8*s.* 9½*d.* The net proceeds of the sales show a profit over the cost of food of £115 17*s.* 6*d.*, or about 2*s.* 3¾*d.* per bird.

These figures are interesting in connection with the production of eggs under present conditions.

The statement given does not pretend to represent a complete profit and loss account, but affords some useful information.

It is clear, for example, that present food prices do not make egg production unprofitable. The ration fed at Morden Hall was not a cheap ration, the ingredients were all of good quality, and *all of them save the water had to be purchased.*

In regard to housing, the results are even more interesting. Mr. Paynter received little encouragement when he proposed to house pullets for egg production in Sussex arks through the winter with no other means of shelter. It was predicted that the results would be anything but satisfactory. The past winter and spring have been characterised by heavy and continuous rains, and by cold winds, and these conditions were calculated to test this method of housing severely. The results indicate that, in the climate of the southern half of England, houses of the Sussex ark type have a wide sphere of usefulness, in addition to the marked advantages of mobility and cheapness.

When the cost of housing these birds is compared with the cost under other systems involving enclosed runs, it will be found both inexpensive and possessed of great advantages in the ease with which the equipment can be moved to fresh ground and re-erected. More expensive housing may tend to increase the egg yield, but the commercial poultry keeper must consider how far the additional outlay tends to increase his actual profit.

In considering these results it is necessary to remember that the records cover 8 months only, and include the most productive period of the year, and that the ground was very heavily stocked (at the rate of nearly 500 birds to the acre), so that the same runs could not safely be used for another year. This would involve a change of ground, and the labour of removing the equipment to a fresh site if a similar stock were retained for laying in 1915-1916.

THE BREEDING OF UTILITY PIGEONS.

A. A. GOODALL.

UNTIL recent years the supply of table pigeons for the English market was practically dependent upon imports from various continental countries, Italy being by far the largest producer of the so-called "Bordeaux" pigeons—long generally recognised as the best type of utility bird. France and Belgium have also each contributed in no small measure to the nation's supply, but imports from the former country have steadily decreased, and those from Belgium are at present nil.

On the other hand, English breeders have, during the last decade, given considerable attention to the improvement of table pigeons, both by the importation of carefully selected stock, and strict attention to mating, with a view to the production of a market bird of all-round excellence. As a result there are now very many British lofts devoted exclusively to the rearing of table pigeons on commercial lines, and satisfactory progress is generally reported. The industry is still young, but the prospects are good, and in view of the steady and growing demand for first-class table "squabs," by which name the marketable birds are known, and of the fact that very little space is required to breed them successfully, the small-holder may with advantage include a small flock of pigeons as a side-line.

Young pigeons, when killed, can be disposed of either locally or in the various London markets, where the best type of "Bordeaux" birds are sold retail at prices often reaching 2*s.* 6*d.* per bird, and even more, when the season is at its height.

There is also a ready sale for young birds required for stock purposes, and many breeders rear birds exclusively to supply this demand, realising remunerative prices for stock of the approved type.

In rearing pigeons for the table it is important to remember that the breeder should only keep very prolific birds, and those capable of producing large, fast-growing squabs, fine in bone and possessing a delicate, white skin.

The best Breeds.—Many kinds of pigeons are reared for table purposes, including common Homers, but the two most suitable are the Carneau and the Mondain, the latter a recognised type of the French Gros Mondain, probably evolved by a series of out-crosses with other allied breeds.

Of the two, the Carneau is perhaps the more prolific and somewhat hardier pigeon, though both are quick breeders and easily kept, even in exposed positions. They are now well established in this country, and readily procurable.

The *Carneau* is a large-sized pigeon, weighing, when adult, from 1½ to 2 lb. It is a native of Flanders, where for generations it has been bred almost exclusively for utility purposes, gaining a reputation second to none as a producer of the best class of table squabs. In colour the birds are either red or yellow, mottled with white, but those most frequently met with in England are wholly red, no particular attention being paid by utility breeders to colour or markings. Small, undersized specimens are frequently offered for sale, but should be avoided, hens especially, such birds being wanting in stamina and unlikely to produce robust stock.

In build the Carneau is a thick-set, compact pigeon, possessing a broad, meaty breast, and a pinky-white skin. It is somewhat short in neck, and, unlike many of the large breeds, is not overburdened with great length of feather in the wings—a decided consideration in the utility loft, where freedom of action and absence of clumsiness are of supreme importance. The legs are pale-red in colour and without feathering, and this, coupled with the fact that the Carneau is active in habit and light upon the wing, renders it an eminently attractive-looking and decidedly ornamental pigeon.

It is also tender with its young whilst in the nest, and an excellent breeder, usually rearing five or six pairs of squabs in the course of the season.

The *Mondain*, in general characteristics, closely resembles the Carneau, but it is larger and thicker in build, and is found in a great variety of colours, mostly interspersed with white; frequently, indeed, it is entirely white. In this breed the legs are in many cases more or less heavily feathered, a feature which must be regarded as detrimental to utility properties, since the quills upon the feet and toes are liable to puncture the eggs during incubation.

In both the Carneau and the Mondain the head is dove-shaped, full in the forehead, and well rounded behind. The eye, which varies considerably in colour, is somewhat prominent, and centrally placed. In specimens showing no white in the plumage the colour of the iris is usually yellow, and this is often the case with parti-coloured birds. White pigeons, however, as a rule possess a dark eye, though not invariably.

The bill is moderately long and slender, the wattle at its base being small and smooth; eye-cere fine in texture and flesh-coloured.

Of first importance is the formation of the breast, which in a typical specimen should be long, deep and prominent. Narrow or flat-breasted pigeons are practically useless for utility purposes, and should be avoided, however good they may appear to be in other respects.

The back is wide at the shoulder, and tapers off towards the tail, which should be fairly short and narrow.

The wings are moderately long, powerful, and carried close to the body; when closed they ought to meet, but not cross, over the tail.

The legs are rather short, stoutly formed and set-on sufficiently wide apart to give the bird a broad, "blocky" appearance, without being ungainly.

Of the two breeds described the Mondain is the more docile in disposition. It is a very prolific pigeon, and though its young whilst in the nest are a little less hardy than those of the Carneau, they mature quite as rapidly, and grow into finer squabs.

Housing.—Pigeons kept for utility purposes do best when confined in a loft or wired-in enclosure, and in arranging such a structure it is well to remember that as much air as possible must be allowed, also that freedom from wind and rain is absolutely essential. A lean-to aviary measuring about 10 ft. by 4 ft., and 6 ft. high, will accommodate half a dozen pairs of birds; it should, however, be covered in for about four feet to protect the nesting boxes or lockers, which may be fixed to the wall by means of brackets. The lockers employed with the greatest success are constructed of boards a foot wide, cut into four-foot lengths, and placed one over the other about eighteen inches apart.

The shelves thus arranged are boarded at either end to the required height, and a door a foot wide is fixed in front at each extremity, leaving the centre open for the alighting board, which should project about six inches in order to facilitate ingress and egress. Behind each door is placed an ordinary earthenware nestpan, half filled with sawdust of medium grade.

This plan not only provides the necessary quiet for the pigeons whilst incubation is in progress, but it also permits of both pans being used simultaneously—an important consideration with quick-breeding pigeons, which generally have a second nest of eggs before the young of the first are old enough to care for themselves.

Pine sawdust, if procurable, is best for litter; it should be sprinkled thickly upon the floor of the nesting-boxes, also on the covered-in portion of the enclosure if the ground is hard and dry, but not otherwise. Its use materially assists in keeping the premises clean and sweet, and if it be raked over and sifted regularly there is no difficulty in collecting the loft droppings which have been absorbed. The latter, it may be remarked, are employed in the process of tanning, and are readily saleable for that purpose. The refuse must, however, be stored in a dry place.

As regards the outer flight, it is advisable, though not absolutely essential, that this also should be protected from rain. Wood and galvanized iron are equally useful for roofing purposes, the main point being to ensure a hard, dry floor, which can be kept clean.

Perching accommodation may be arranged according to circumstances and the space at command. Flat perches, about an inch wide, are preferable, as they are easily scraped down.

Breeding.—The breeding season proper commences about the first week in February, and continues until the end of September. Some pigeon-keepers advocate winter breeding; but unless relays of birds can be employed for the purpose, and warm quarters—artificially lighted—are at command, it is likely to prove unprofitable.

Actually mated pairs only should be admitted to the loft: all other birds, whether cocks or hens, constitute a distinct danger to the general harmony of the place, and must be rigorously excluded.

Previous to mating the sexes should be kept apart, as much fresh air and exercise as possible being allowed them, with a view to encouraging hard condition. A small quantity of hemp seed, added to the food supply, is useful at this time; barley also is to be recommended.

Only birds that are perfectly healthy should be employed in the stud, and on no account must closely related pigeons be mated together.

The best results are obtained by mating hens two or three years old with young cocks, or *vice versâ;* pigeons under the age of twelve months should never be allowed to breed together if robust offspring are desired.

When a selection of the breeding stock has been made, the intended pairs may be shut up together in the nesting boxes above described; this can easily be accomplished by fastening

a small wire frame across the aperture of the locker. Here they may remain until nesting operations have commenced, after which the birds may be liberated for an hour or two each day until they have become accustomed to their surroundings, by which time complete liberty may be allowed. Two eggs only are laid, and the period of incubation is nineteen days.

The young pigeons, when first hatched, are practically nude, except for a scant covering of silky down, which gradually gives place to feathers as growth proceeds. Being entirely dependent upon the parent birds for their food supply, the squabs require no special attention at the hands of the owner, who should be careful to remember that it is advisable not to interfere with them for the first week or ten days, or the old pigeons may become restive and trample upon their offspring. Such precautions, however, need not be observed when the young are old enough to be left unbrooded by the parent birds; it is then, indeed, an advantage to remove them from the nestpan and place them on the floor of the locker, where the old pigeons will continue to feed them. The nestpans should, during hot weather, be dressed with paraffin, both inside and out, as a preventative against red-mite.

The Food Supply.—The food offered to table pigeons ought at all times to be clean, dry, and thoroughly sound. It is false economy to feed on low-priced, apparently cheap grain, which is usually shrivelled, tainted, or otherwise unsuitable. The following mixture is useful for general purposes:—Equal parts of wheat (red), either white or maple peas, dari, and, during the cold weather, broken maize. To this may be added clipped oats, bread (crumbled), and coarse biscuit-meal, all of which, though not given to fancy pigeons, make excellent feeding for utility birds.

Buckwheat, hempseed, barley, millet and chicken-rice may also be employed with advantage from time to time, as a change. Such pulses as beans and tares are too expensive for general use, but both are of great value as flesh-formers. As regards maize, experience has proved that, while it can be freely fed to pigeons enjoying their liberty, it has a tendency to create fat in the case of confined birds, and if used without discrimination will ultimately ruin the stock for breeding purposes. For this reason it cannot be recommended for general use, though as already remarked, during cold spells it is distinctly beneficial.

Pigeons should be fed twice daily, in the morning and evening. In order that the food may not be fouled it is desirable to place it in a hopper or earthenware pan on the floor of the loft; an ordinary nestpan answers admirably for the purpose, as it is easily cleaned and washed. Should it be

found impracticable to give an evening meal, sufficient food may be left in the hopper for the day's supply, which a little experience will enable the amateur to gauge almost to a nicety.

The grain supply should be stored in a cool, airy place, free from damp, and with as much surface exposed to the atmosphere as possible.

Shallow, open troughs are best suited for storage purposes, as the grain can then be stirred periodically and kept sweet and pure; it is also advisable to sift all grain previous to use in order to remove any dust or foreign matter. Grain, if stacked in bulk, is apt to ferment in warm, damp weather, and may cause bowel trouble if fed to the pigeons in that condition.

Grit and lime are both essential to the health of the flock. The first-named, which is necessary to promote digestion, may consist of good, hard flint grit, mixed with calcined (burnt) oyster-shell; while the lime may be given in the form of a mixture of old mortar rubbish, coarse sand and ordinary table salt, damped and allowed to dry off and cake. A vessel containing a supply of each of these commodities should be placed in the loft, under cover, and be replenished from time to time.

For holding drinking-water there is nothing better than the ordinary earthenware fountain, as manufactured specially for pigeons, and in general use among breeders. It must be cleaned and refilled regularly, and should be stood in a cool place away from the sun's rays.

Pigeons are inordinate bathers, and must be supplied with a wide, shallow water-pan, of which they will make the fullest use for cleansing and beautifying their plumage. A pan of galvanized iron, without any soldering, will be found most convenient; it should be offered every other day during the summer months, and twice a week in winter, care being taken to remove the vessel after use.

Preparing for Market.—Well-grown squabs are ready for killing when between four and five weeks of age; after that they lose flesh and are no longer the succulent morsels it is the business of the utility breeder to produce.

If the squabs have been properly nourished, no special preparation is required to fit them for the table, though it is customary in the trade to fatten imported birds by artificial means, probably because they become thin owing to the rough treatment to which they are subjected whilst travelling. Millet seed and tares are employed for this cramming process, which is carried out by experts; the amateur breeder, however, will find the work too troublesome to be profitable.

At the age above mentioned, the weight of a Mondain squab should be from 1 to 1¼ lb., and that of a Carneau somewhat less.

Occasionally a weight of 2 lb. is reached by extra fine specimens, but for all practical purposes squabs weighing a pound apiece, on an average, are sufficiently large, and likely to be better in quality than heavier birds.

There are two methods of killing, viz. :—By dislocating the neck, near the head, and by severing the jugular vein with a knife. The latter is most in vogue among breeders supplying the London and other big markets, but there seems no real reason why breaking the neck, as practiced with poultry, should not be equally effective, seeing that, when properly performed, the operation is cleaner and completely drains the body of blood.

After killing, the body should at once be denuded of feathers and hung up to cool. Care must be exercised in plucking not to tear the skin, or there will be disfigurement and subsequent loss in value.

Dressing next follows, and is easily performed by folding the wings behind the back, and tucking the legs backward under the thigh. There is no necessity to remove the intestines at this stage.

The appearance of the carcass can be greatly improved by placing it, breast downwards, on a shaping board similar to that used for poultry. If the birds are laid out in a row and the top board is well weighted, they will quickly assume the required flatness, after which they are ready for packing. Shallow boxes, constructed to hold either six or eight pigeons, are used for this purpose ; they should be lined with clean, white paper, crimped at the edges.

In some districts dealers prefer to buy live pigeons rather than those already dressed. Only birds, however, known as "squeakers," that is those which still utter the nestling note, are suitable for this market, a point the intending breeder will do well to bear in mind.

ENSILAGE.

THE system of ensilage was at first advocated mainly as a resource when wet weather prevented the saving of the hay crop in good condition, the contention being that it was preferable, under such circumstances, to convert grass and other fodder crops into silage. It was on these grounds that the system was first widely adopted in the year 1888. It may be reasonably

claimed, however, that the utility of the system is equally, if not more, marked in a year of drought, or when the root-crop fails, as by its means green fodder may be economised and stored *in a succulent state* for winter keep.*

When ensilage was first introduced it was generally considered that the making of silage involved the construction of a silo, *i.e.*, a receptacle of some kind with sides of brick, stone or concrete. This was often too expensive for tenant farmers, and in some cases outhouses, parts of barns, and other buildings were converted for use as silos at comparatively small cost. A considerable stimulus, however, was given to the system by the discovery that good silage could be made in stacks and clamps by a comparatively cheap and simple process.

Materials Suitable for Silage.—Meadow grass, Italian rye-grass, grass and clover mixtures, maize, lucerne, clover, sainfoin, vetches, and any other green fodder crops that can be spared from the immediate requirements of the farm stock may be made into silage. As a rule the four last-mentioned crops, and legumes generally, make the best silage when mixed with a grass or a cereal. Hay aftermath, top-dressed if necessary with quick-acting manures, might also be converted into silage, especially when weather conditions are apt to render the saving of a second hay crop difficult or impossible. At several centres in the South-Eastern Counties, where roots are often a precarious and costly crop, a considerable proportion of the root "break," for the past year or two has been specially devoted to the growth of silage crops, usually a mixture of vetches, cereals and a sprinkling of beans. Sown in autumn this mixture proves an effective "smother" crop, and is ensiled during the early part of July. As soon as possible after the removal of the crop the land is broken up and usually fallowed till wheat is sown in autumn. In some cases, however, it is found possible to follow immediately with a quick-growing green crop, such as rape, mustard or soft turnips. In America by far the most important silage crop is maize, to the cultivation of which increased attention has been given in recent years in England. For an account of the cultivation of maize for fodder, Leaflet No. 73 may be consulted.

If the object in view is to provide for the deficiencies of a season of drought, autumn silage crops should be allowed to stand as late as the weather will permit.

All classes of herbage upon farms may, if necessary, be utilised for silage, even nettles and other weeds having been successfully

* See also p. 372.

employed. The margins of fields and the sides of hedges and other waste places may be brushed and the material so obtained ensiled. The leaves and young shoots of most hardwood trees may also be utilised. If the material is too coarse for actual silage it will be useful for topping up the silos, stacks, or clamps. Coarse grass in meadows, pastures, and under trees in orchards and elsewhere, which stock frequently reject, may be made into eatable silage. Hop bines may be ensiled directly the hops have been picked, before the sap has disappeared.

Making of Silage.—Silage may be made in special pits, in stacks or clamps, in ordinary buildings adapted for the purpose, or in a specially designed structure, such as the round stave or concrete silo so popular in America. Although the details of the various methods of making silage differ somewhat, the main features are the same in all. The chief essential is compression, to exclude air, and this object is usually best attained when the silage crops are cut while still immature and carted soon afterwards.

Silage made in a silo or clamp is usually sour, while silage made in a stack is almost invariably sweet. To prepare sweet silage the material should be added somewhat slowly to ensure a temperature of from 130° F. to 160° F., which apparently renders inactive the organisms in the material which are responsible for the production of acids. If by rapid filling and pressure air is excluded the temperature does not rise so high and sour silage is produced.

The results of feeding trials and chemical analyses show that there is no marked difference in the feeding value of sweet and sour silage. The sweet variety, however, has a less powerful smell, and on that account is to be preferred in the feeding of milch cows.

In the case of the stack or clamp or other temporary silo no special preparation of the silage crops is necessary before ensiling. When, however, the tall, round stave or concrete silo is used, the material is usually roughly chaffed before it is transferred to the silo by elevator or blower.

Silage Stacks.—Silage is stacked in the same way as hay, in circular, square, or oblong stacks. It is important that as much material as possible should be put together in one stack so as to reduce waste at the outside. A depth of 3 or 4 feet is put on every day or two and care must be taken that the temperature does not rise above 150° F. Rise of temperature is checked by throwing on more fodder so as to increase the pressure. As building progresses the stack must be carefully and firmly trodden, especially near the outsides, and the fodder should be

thrown on from different sides in succession. In the case of square or oblong stacks poles may be pitched at the corners and sides, and braced together at the top to guide the stack makers. A framework of four large planks may be made round the poles, and drawn up as the stack progresses by pulleys fastened to each end of the bracing at the top. This will keep the stack shapely, and allow the outsides to be well trodden down. The boards may be used to cover the stack when finished, and then be heavily loaded with bricks, stones, or other weighty substances. The whole should be covered with straw or other material to keep out rain.

Round stacks should be built slowly and not weighted until complete. A layer of rough grass or weeds should be put at the bottom, and similar material used to top up. The surface should be trodden down, and sand or earth laid on the top to a depth of not less than 12 inches. The usual procedure is to dig a trench round the stack, and use the soil thrown out to cover the silage. Sand and earth have been found the most useful materials to ensure even pressure. Finally, a layer of rushes, bracken, or similar material may be put on and weighted down to act as thatch. In building the stack it should be kept full in the middle, in order that it may finish convex. Materials for making a silage-stack should, as a rule, be used whole, and be carted immediately after cutting.

The system of making silage in stacks involves the waste of a certain amount of material round the outsides. The method, however, is very valuable, especially in cases of emergency. The initial expense of making a silo is saved, and a stack can be erected in any convenient position.

Silage Clamps.—Clamps are advocated by practical men in the absence of a silo, when silage must be made immediately. They are best made on slightly sloping ground and should be oblong in shape. The carts should be drawn on and over the heap precisely as in the case of a manure clamp, and tipped where material is required to fill up. They must be drawn as closely to the sides as possible so as to give pressure there. When the middle has risen too high for further carting the sloping ends and sides should be cut off, the material being thrown on to the clamp, levelled, and firmly trodden in. Good silage can be obtained by this method from very wet material. Finally, dry earth should be laid evenly upon the clamp, to a depth of 10 inches, preferably with an intervening layer of rough herbage, bracken or leaves.

Old chalk pits, so numerous in some districts, form serviceable receptacles for silage. The carts should be led over the

mass of green material, which must be finally left in a somewhat conical form, and covered with earth to a depth of from 10 to 12 inches.

Where earth is used as a covering for silage stacks or clamps, occasional inspection is necessary, as the earth sinks with the silage, and cracks are sometimes formed. These cracks should be filled up.

Silos.—Specially constructed silos will naturally be used when available, but buildings that can be readily and economically converted may be utilised as temporary silos. Cheap stave or concrete cylindrical silos, now so common in America, may also be built. These silos are usually from 20 to 40 feet high and from 10 to 20 feet in diameter. The following table shows the relation between the size and capacity of silos of different dimensions:—

Approximate Capacity of Cylindrical Silos for well-matured Maize Silage in tons (King, Wisconsin).

Depth of silo (feet).	Inside diameter of silo (in feet).					
	10.	12.	14.	16.	18.	20.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
20	26	38	51	67	85	105
22	30	43	59	77	97	120
24	34	49	66	87	110	135
26	38	55	74	97	123	152
28	42	61	83	108	137	169
30	47	68	93	119	151	187
32	51	73	101	131	166	205
36	64	105	130	155	190	235
40	75	121	150	180	228	279

It is stated that somewhat larger quantities of immature crops can be compressed into the same space. The material is first chaffed by power, and then elevated into the silo. The deep stave silo has a number of advantages. It can be made practically air-tight. The chaffing of the fodder and the greater depth of the silo as compared with its diameter ensure sufficient compression without artificial weighting. The smoothness of the walls ensures uniform settling, and the loss from spoiled silage, both at the top and as emptying progresses, is relatively low.

The cost of cylindrical silos will vary according to the relative prices of timber and cement. At the present time a stave silo, 36 feet deep, and 18 feet in diameter would cost about £150.

The Use and Value of Silage.—Many stock-owners make silage regularly, and use it as a valuable addition to ordinary

food for stock. There is abundant testimony as to its value for feeding milch cows as well as breeding ewes. For fattening beasts it has been claimed that well-made silage is as valuable as a combination of hay and turnips, and for lean stock of all kinds it may be used as a substitute for either hay or roots. Farm horses will do well on properly-made silage.

As a rule silage should not be mixed with other forage when fed. About 40 lb. per day is a common allowance for a cow. In seasons when hay and straw or roots are scarce, silage will prove of great value for supplying the bulky succulent food that is essential for the health of ruminants.

NOTE.—The subject of ensilage received considerable attention at the hands of the Agricultural Department of the Privy Council in 1885, and, as the result of an exhaustive local inquiry, a summary was published of Replies to Questions on Silos and Ensilage in Great Britain, in the form of a Parliamentary paper.* This was followed by a reproduction of the Reports of the private Ensilage Commission.†

The Composition and Value of Liquid Manure.

THE chemical composition of liquid manure as produced under the farming conditions of the North-East of Scotland is discussed in a bulletin‡ published by the North of Scotland College of Agriculture, and an account is given of the results obtained over a series of years with this manure for the hay crop.

Liquid manure, it is explained, consists mainly of the urine of animals and of the drainage from manure heaps during the rotting of the dung, mixed in many cases with rain water. The urine is the most important part, and contains both nitrogen and potash, but very little phosphate. Its potash content has increased the value of urine since the outbreak of war, as German sources of potash manures have been cut off.

The quality of the urine depends to a large extent upon the amount of water taken by the animal with its food. Turnips, *e.g.*, contain about 90 per cent. of water, and as it has been repeatedly shown that from 50-60 lb. of turnips contain sufficient water for the requirements of bullocks,

* C.—4536. † H. C. 308 of 1885 and H. C. 119 of 1886.
‡ North of Scotland College of Agriculture, Bull. No. 19, *The Composition and Value of Liquid Manure:* Professor James Hendrick.

it follows that the larger the quantity of turnips above this consumed, the poorer is the quality of the urine. Two experiments, in Scotland and England respectively, are cited by Professor Hendrick to illustrate the point. The amount and quality of the urine obtained in these experiments by varying the root feeding is shown in the following tables :—

Scottish Experiment.

Food per Day.			Excretion.		Urine Content in	
Turnips.	Straw.	Linseed Cake.	Dung.	Urine.	Nitrogen.	Potash.
lb.	lb.	lb.	lb.	lb.	Per cent.	Per cent.
119	9½	0	29	58	0·22	—
60	13¼	3	39¼	15¼	0·58	—

English Experiment.

Food per Day.			Excretion.		Urine Content in	
Mangolds.	Lucerne Hay.	Water.	Dung.	Urine.	Nitrogen.	Potash.
lb.	lb.	lb.	lb.	lb.	Per cent.	Per cent.
150	0	0	42	88	0·124	0·597
0	26	66	48	14	1·51	1·69

In districts, therefore, where dry foods are mainly used and roots are given only in small quantity, or not at all, the bulk of the urine is small, easily soaked up in the litter, and retained in the dung. Under such conditions the dung is enriched by the nitrogen and potash of the urine and it is less necessary to make special arrangements for dealing with liquid manure.

The importance of the proper collection of the urine where large quantities are produced is increased by the consideration that the nitrogen in the roots, which produce these large quantities, is very well digested, so that only 10 or 20 per cent. of the total nitrogen is contained in the dung, at least 90 per cent. of the remainder being voided in the urine ; and the same holds true as regards the potash. Further, the nitrogen and potash in the urine are in a form immediately available for the use of crops, so that both these manurial ingredients are, weight for weight, as valuable and as quick-acting as those of any other manures the farmer can purchase. The nitrogen and potash in the dung and the straw are, on the other hand, relatively slow in their action on crops.

In the present investigation 35 samples of liquid manure from farms in the North-East of Scotland were analysed, with the following results :—

	Average per cent.	Maximum per cent.	Minimum per cent.
Water	98·21	99·33	96·46
Solids	1·79	3·54	·67
Total Nitrogen	·204	·470	·088
Including Ammoniacal Nitrogen	·179	·410	·060
Phosphoric Acid	·029	·090	·004
Potash	·462	1·030	·128
Lime	·019	·043	·003

In the feeding a considerable quantity of turnips was used, together with straw, and sometimes a little hay; oats and various kinds of cake were added to this basal ration, and in the case of milking cows some "draff" (wet grains) was also used. The varying amounts of rain-water which gained access to the collection tanks in different instances caused much greater differences in the composition of the various samples than the feeding; so far as the evidence went, however, it did not indicate that even if rain were entirely excluded from the tanks the average solids would be much higher than 2 per cent. or the average nitrogen above 0·3 per cent.

The weight of 1,000 gallons of liquid manure would be about 10,000 lb. or nearly $4\frac{1}{2}$ tons. This quantity would contain :—

Nitrogen, about	$20\frac{1}{2}$ lb.
Phosphoric Acid, about	3 ,,
Potash	$46\frac{1}{2}$,,
Lime	2 ,,

The content of nitrogen would be equal to that present in 100 lb. of sulphate of ammonia, and, on the basis of *7d.* per lb. of nitrogen, would have a value of 12*s.* The potash is more than that present in 3 cwt. of kainit, and at the pre-war price of 2*d.* per lb. might be valued at 8*s.* The value of the phosphoric acid present would be about *7d.*, while the lime would have practically no value. Liquid manure as collected in the North-East of Scotland would, therefore, have a value of about 4*s.* 6*d.* per ton as manure, reckoning the potash at pre-war prices, or of about 6*s.* 3*d.* per ton, assuming potash to have doubled in price.

Liquid manure is suitable for a good many crops, but hay was chosen for these experiments on account of the ease with which the results of application could be ascertained.

The applications were carried out at different times during the winter, viz.: (1) in December, (2) at the end of January, and (3) in March, as it was thought that in the case of the two earlier dressings, in spite of assertions by practical men to the contrary, little of the potash would be lost and that a great part of the nitrogen might also be saved. The standard dressing of liquid manure adopted was 2,000 gal. per acre, which was generally given in two dressings of 1,000 gal. each at an interval of a few days. For distribution purposes a barrel-cart was used.

In all, twelve experiments were carried out over four seasons, and in every one a marked increase of crop was obtained from the application of liquid manure; further, the increase obtained by applications in December was, on the average, about as great as that obtained from March applications. This is brought out in the following table:—

——	Time of Application.	Weight of Hay per Acre.
		lb.
Untreated	.. ..	4,512
2,000 gal. per acre ..	December	5,557
2,000 ,, ,, ,, ...	January or February ..	5,768
2,000 ,, ,, ,, ...	March	5,610
1,000 ,, ,, ,, ...	December	5,719
1,000 ,, ,, ,, ...	March	
2,000 ,, ,, ,, ...	December	6,075
2,000 ,, ,, ,, ...	March	

With fine, mild weather early in the season plots receiving an early dressing began to grow early and obtained a start over those dressed later; but with a cold and wet early season the advantage of the early-dressed plots was more or less lost; while with dry weather in May and June the plots dressed late, especially on light, thin land, were retarded by the drought, and the advantage of the plots dressed early was increased.

For practical purposes, therefore, Professor Hendrick recommends dressing at intervals throughout the season as might be found convenient, each part of the area being gone over two or three times in the course of the winter.

From the financial point of view the experiments showed that (valuing the hay at 51s. per ton) about 25s. per acre was obtained from an application of 2,000 gal. of liquid manure, quite apart from the value of the improved aftermath, which was undetermined, but estimated at 5s. per acre. If the

unexhausted value of the potash is placed at one-half the original dressing (*i.e.*, 8s. per 2,000 gal. at pre-war prices) the total return would seem to have been about 38s. from the liquid manure, the value of which, based on its manurial ingredients, was placed at £2 (see above).

The dressing of 4,000 gal. per acre was shown to give an insufficiently good return for the extra 2,000 gal. applied (see above table).

Treatment with liquid manure had a beneficial rather than a detrimental effect on clover.

In conclusion, Professor Hendrick points out, that when liquid manure is applied to pasture, the latest dressing would require to be given some weeks before the cattle are to be turned on to the grass, so that all trace of the liquid manure and its smell, which would probably interfere with the relish of the cattle for the grass, would have had time to disappear. Probably it would be an additional benefit, in the case of pasture, that an early growth would be obtained which would provide food for stock at a time of year when it is often scarce.

The International Institute of Agriculture: Proceedings of the Permanent Committee.

AT the meeting of the Permanent Committee held in April there was little business of importance to be done, but as the date for the Meeting in May approached, and it became more and more probable that Italy would take part in the European War, the tension in Rome became greater, and the difficulty of carrying on the work of the Institute increased. The Delegates for Austria and Hungary left Rome, and the members of the Staff who belong to those countries and to Germany found it advisable to return to their homes. According to the regulations, the Permanent Committee should hold a meeting in the month of June, but there was a general feeling among the Delegates that it would be better in the permanent interest of the Institute that they should wind up the work of the Session and separate before the state of war actually arose. Accordingly, at the meeting of the 18th May the Committee decided to begin the annual vacation at once, and to leave the President and the Staff to maintain the working of the Institute, so far as it was possible to do so in the present critical circumstances. Now that Italy has entered into the war, nearly half of the Permanent Staff, which ordinarily consists of about a hundred members,

have had to leave Rome either because they have been summoned to serve in a military capacity, or because they belong to countries at war with Italy, so that it will be impossible for the Institute to do so much work as is ordinarily to be expected from it. The Committee, however, directed the Staff to ensure that the three monthly Bulletins are issued as regularly as possible, to endeavour to issue the new Statistical Annual in the month of August, and to publish in August or September statistical tables relating to the production, import, export, prices and freights of cereals, similar to the tables circulated in the month of March. They hope in this way to be able to keep the current work up to date, to meet again as usual in the month of October, and when peace is declared to resume the functions of the Institute with full vigour.

As it was recognised that, should Italy enter into the war, it would be impossible for the employees belonging to hostile countries to remain at Rome, the Committee decided to extend to them, even if they were not summoned to military duty, the same generous treatment which it had already granted to employees belonging to the belligerent countries who had been called to the colours. That is to say, they were to be allowed during their enforced absence a maximum of six months' pay, and to be permitted, so far as possible, to resume their duties at the Institute on the conclusion of peace.

In accordance with the desire of the representatives of the English-speaking countries, it was resolved to adopt new titles for the English edition of the three monthly Bulletins, more intelligible to English readers than the present titles, which are too close a translation of the French. The new titles will be (1) International Crop Report and Agricultural Statistics, (2) International Review of the Science and Practice of Agriculture, (3) International Review of Agricultural Economics.

Advice to Pig Feeders.

THE Department of Agriculture and Technical Instruction for Ireland consider that the following opinions expressed by the Committee on the Irish Pig Breeding Industry cannot be too widely known :—

1. The prospects of the industry are good. The numbers of pigs in countries which export bacon to Great Britain are falling off, and it may be anticipated that, in consequence, exports of bacon will shrink, and that Irish bacon will be in great demand. The number of pigs in Ireland should, therefore, be increased.

2. It is not necessary to cook meals for pigs. Steep the meals in cold water and feed raw; just as good results will be obtained and labour and fuel will be saved.

3. About 5 cwt. meal will produce 1 cwt. pork.

Given in conjunction with other foods—

About 4 lb. potatoes equal 1 lb. meal in feeding value.

About 6 lb. separated milk equal 1 lb. meal in feeding value.

Separated milk given with meal and potatoes is now worth 2*d.* per gallon.

4. Farmers should breed the pigs they fatten, and thus secure the profit of both breeder and feeder.

5. More home-grown foods should be produced for feeding to pigs. Barley, oats and potatoes are most suitable.

The Department learn that in some cases farmers have used cod-liver oil in the food for pigs. This is a most undesirable practice, as the oil imparts an objectionable, fishy flavour to the pork, which is not removed even by the process of curing.

Farmers, therefore, are most strongly urged not to feed cod-liver oil to pigs under any circumstances, The use of this oil is not necessary; it injures the reputation of Irish bacon; it is unfair to bacon curers, and, above all, it re-acts against the farmers' own interests.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURES.

The Atmosphere of the Soil (*Jour. Agric. Sci.*, March, 1915; *E. J. Russell* and *A. Appleyard*).—The free air in the pores of the soil to a depth of six inches is very similar in composition to the atmospheric air, but it differs in that it contains more CO_2 and correspondingly less oxygen and shows greater fluctuations in composition. Usually the sum of the CO_2 and oxygen is only slightly less than in atmospheric air, but at periods when nitrates rapidly increase there is a perceptible falling off of oxygen, and a still greater one in waterlogged soils.

Besides this free air there is another atmosphere dissolved in the water and colloids of the soils; this consists mainly of CO_2 and nitrogen but practically no oxygen.

The fluctuations in composition of the free soil air are mainly due to fluctuations in the rate of biochemical change in the soil. The rate of biochemical activity attains a maximum value in late spring and again in autumn, and minimum values in summer and winter. In autumn the bacteria increase first, then the CO_2 rises, and finally the nitrate increases.

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

The dominating factor appears to be, from November to May, the soil temperature and, from May to November, the rainfall and to a less extent the soil moisture. Rainfall, besides adding water to the soil, brings in dissolved oxygen which is probably a factor of considerable importance in renewing the dissolved soil atmosphere and facilitating biochemical change.

No evidence could be obtained that the growing crop markedly increases the amount of CO_2 in the soil air, and if it gives rise to any great evolution of CO_2 in the soil it apparently exercises a correspondingly depressing effect in the activities of soil bacteria.

Such weather conditions as barometric pressure, wind velocity, variations in temperature from the mean, small rainfall, etc., seem to have but little effect on the soil atmosphere.

The Manurial Values of Corn and Cake Compared (*Woburn Field Expts.*, 1914; *Jour. Roy. Agric. Soc.*, 1914; *J. A. Voelcker, D.Sc.*).—In 1910 swedes were fed on the land to sheep with corn and cake respectively. The succeeding crops were barley in 1911, green crops in 1912, wheat in 1913, and swedes in 1914. The following table shows the results obtained:—

Year.	Crop.	Corn-Fed Plot.	Cake-Fed Plot.
		Per acre.	Per acre.
1911 ..	Barley ..	28·5 bush.	23·8 bush.
1912 ..	Trifolium (cut as hay)	1 ton 19½ cwt.	1 ton 16¾ cwt.
1913 ..	Wheat ..	26·7 bush.	22·7 bush.
1914 ..	Swedes ..	7 tons ¾ cwt.	6 tons 19 cwt.

The superiority of the manurial value of the corn over that of the cake is unexpected, and the experiment is being repeated.

Green Manuring (*Woburn Field Expts.*, 1914; *Jour. Roy. Agric. Soc.*, 1914; *J. A. Voelcker, D.Sc.*).—On Stackyard Field, in 1914, rape proved the best green manure crop for wheat, both as regards yields of corn and straw, mustard coming second, while the crop after tares was the smallest of the three.

Relation of Lime to Magnesia in Soils (*Woburn Pot Culture Expts.*, 1914; *Jour. Roy. Agric. Soc.*, 1914; *J. A. Voelcker, D.Sc.*).—In 1914 barley, the sixth consecutive corn crop, was grown in this test. It is clear from this trial that the addition of lime to a soil rich in magnesia is beneficial, and that lime can be applied without detriment even where the lime is double the amount of magnesia present in the soil.

Experiments on the Acidity of Soil (*Woburn Pot Culture Expts.*, 1914; *Jour. Roy. Agric. Soc.*, 1914; *J. A. Voelcker, D.Sc.*).—Soil was taken from various continuous barley plots in the Stackyard Field at Woburn, and the acidity and amount of lime required for neutralisation determined by Dr. Hutchinson (see this *Journal* June, 1915, p. 255). The soil from each plot was then treated in three different ways, viz., (1) untreated, (2) sufficient lime added to neutralise the acidity, and (3) an excess of lime added. The lime was added in the form of finely-ground carbonate of lime.

In two plots on which sulphate of ammonia had been applied alone and along with mineral manures respectively, soil acidity had gone so far that a crop could not be produced, and in these cases it

was found that carbonate of lime could advantageously be added to an extent exceeding that required to neutralise the acidity present. But where, although acidity was indicated, a fair crop was still obtained, as was the case on the unmanured plot and the plot that received both sulphate of ammonia and four tons of lime (1897 and 1905), no advantage was obtained by adding carbonate of lime even to neutralising point. Lastly, when no acidity at all was shown, as was the case on two further plots which had received lime dressings, further liming was shown to be thrown away.

In no case was any harmful effect obtained from using carbonate of lime, and it is thought that there is no doubt that the harmful effects of liming on one of the plots in the continuous wheat experiment must be due to the fact that lime was applied there in the caustic state.

Radio-Active Manure (*New Jersey Agric. Expt. Sta., Bull.* 269).—Pot experiments were carried out with a radio-active manure sold at £42 per ton by the Radium Products Corporation of New York City. No appreciable effects, one way or the other, were produced.

Sulphur as Manure (*Fühling's Landw. Ztg.*, 1st and 15th May, 1915.)—The experiments carried out with sulphur in recent years are reviewed and the results carefully analysed. The conclusion is reached that no case has been made out for the use of sulphur as manure in agriculture.

FIELD CROPS.

Varieties and Selection of Seed of Flax (*Jour. Dept. of Agric. and Tech. Instr. for Ireland*, April, 1915).—The average returns per acre, at ten centres, from flax and tows in the case of the varieties tested, were as follows :—

Variety.	Returns. £ s. d.
Dutch Riga Child, imported by the Department	14 17 7
Belfast Dutch, purchased in Ulster	11 11 3
Irish Saved, 3rd year's selection	8 18 7
Pernau Crown, imported by the Department	12 17 11
Belfast Riga, purchased in Ulster	11 14 8

These results, taken in conjunction with those of previous years, are considered to afford conclusive proof that the choice of the variety of flax seed to be sown (*i.e.*, whether Dutch or Russian) should not be governed either by the class of soil or by the district for which it is intended, but by the quality of the seed itself.

In a further series of trials in 1913, the largest monetary returns were obtained from the standard varieties of seed, viz., Pernau Crown and Dutch Riga Child, as compared with three different classes of Irish saved seed and four varieties of seed from the more easterly flax growing districts of Russia. Old seed of Pernau Crown (*i.e.*, grown in 1911) gave slightly better results than the new seed of this variety.

The tests, which sought to ascertain whether the flax plant could be improved for fibre production by making in successive years a selection of seed from long stalks, were continued in 1913. Seed specially selected in this way gave an approximately equal yield of straw, but as regards flax inferior results both in scutching and in spinning were obtained, as compared with Pernau Crown seed. In the previous trials the specially selected Irish seed of the same strain gave in 1911 superior, and in 1912 only slightly inferior, results to Pernau

Crown. The poor results in 1913 may perhaps indicate that these strains of seed lose their original vigour when grown for successive generations in Ireland; and it is stated that it does not appear hopeful that it will be possible in Ireland to improve the flax plant for fibre production by making in successive years a selection of seeds from long stalks.

Manuring of Flax (*Jour. Dept. Agric. and Tech. Inst. for Ireland*, April, 1915).—The experiments conducted by the Department from 1901 to 1912 showed the application of potassic manures to the flax crop to give profitable increases; kainit and muriate of potash, which were about equal in value, gave better results than sulphate of potash. There was no difference in the results from the first two whether they were applied in winter or at the time of sowing.

The use of phosphatic manures was almost invariably attended with a loss, owing to the encouragement of the growth of weeds; and the application of agricultural salt was not remunerative.

Variable results were obtained in different seasons and at different centres with sulphate of ammonia, and the 1913 experiments were, therefore, designed to test this manure further. On the average of 10 centres a higher yield of 3 st. 11 lb. of scutched flax per acre resulted from the application of ½ cwt. sulphate of ammonia per acre in 1913, which left a profitable increase of £1 4*s.* 3*d.* after deducting the cost of the manure.

The addition of ½ cwt. sulphate of ammonia to dressings of 1½ cwt. and 1 cwt. muriate of potash per acre gave, on the average, increased profits over those from the potash dressings alone of 11*s.* 11*d.* and 13*s.* 8*d.* per acre. These and former results are taken to show that in most seasons the addition of a light dressing of sulphate of ammonia to muriate of potash will prove effective.

More remunerative results were obtained in 1013 from the application of 1½ cwt. muriate of potash than from 1 cwt. of this manure per acre, whether applied alone or along with sulphate of ammonia.

Liming for Flax (*Jour. Dept. Agric. and Tech. Instr. for Ireland*, April, 1915).—The lime was applied in 1912 at the rate of 2 tons of burnt lime per acre, and the plots were cropped in 1912 with oats and in 1913 with flax. On both the limed and unlimed plots the effect of 1 cwt. muriate of potash was tested for the flax crop. The profits from the dressings were as follows (one-quarter of the cost of the lime is charged to the flax):—

	Profit over Untreated Plots.
Untreated	—
1 cwt. muriate of potash	6*s.*
2 tons burnt lime	£2 9*s.* 10*d.*
2 tons burnt lime 1 cwt. muriate of potash	£4 0*s.* 4*d.*

Green Manuring of Barley (*Rothamsted Expt. Sta., Ann. Rept. for* 1914; *E. J. Russell, D.Sc.*).—Four crops were ploughed in and the following yields of barley were obtained per acre:—Rape: grain 18·9 bush., straw 15·4 cwt.; crimson clover: grain 15 bush., straw 14 cwt.; vetches: grain 21·5 bush., straw 18·9 cwt.; mustard: grain 18·8 bush., straw 15·1 cwt.

Growth of Barley after Leguminous Crops (*Rothamsted Expt. Sta., Ann. Rept. for* 1914; *E. J. Russell, D.Sc.*).—Barley was grown after various legumes in order to test the amounts of nitrogen accumulated

by the latter and left in the soil. After lucerne, the yield per acre was 33 bush. of grain and 17·6 cwt. of straw; after red clover, 20·3 bush. of grain and 10·6 cwt. of straw; and after alsike clover, 21·9 bush. of grain and 11·3 cwt. of straw.

Varieties of Oats (*Woburn Field Expts.*, 1914; *Jour. Roy. Agric. Soc.*, 1914; *J. A. Voelcker, D.Sc.*).—The yields of head corn per acre, in bush., were:—Svalöf Victory 37·4, Banner (Canadian) 34·5, Mammoth White Cluster (Canadian) 32·8, Newmarket 32·7. Svalöf Victory also produced most straw and obtained the best price in the valuation.

Manuring of Oats (*Rothamsted Expt. Sta., Ann. Rept. for* 1914; *E. J. Russell, D.Sc.*).—Winter oats manured with 106½ lb. of nitrolim per acre yielded 2 bush. of grain per acre more than those receiving the same amount of nitrate of soda and nearly 5 bush. per acre more than unmanured oats.

Clover and Grass Mixtures (*Woburn Field Expts.*, 1914; *Jour. Roy. Agric. Soc.*, 1914; *J. A. Voelcker, D.Sc.*).—The merits of wild white clover and ordinary white clover for inclusion in seeds mixtures were tested. A mixture containing wild white clover yielded 1 ton 19 cwt. of hay per acre; the same mixture, substituting an equal weight of ordinary white clover seed for the wild white clover, yielded 2 tons 4 cwt. per acre; on a third plot wild red clover sown alone produced 9½ cwt. After the removal of the hay, however, the wild white clover was found to cover the ground more closely than the ordinary variety, giving a much thicker "bottom" for pasturage. The same was noticeable with the wild red clover.

Varieties of Lucerne (*Woburn Field Expts.*, 1914; *Jour. Roy. Agric. Soc.*, 1914; *J. A. Voelcker, D.Sc.*).—Seven varieties of lucerne were compared in 1914, as for several years past, both when sown under a corn crop and when sown bare. The yields per acre in 1914 were as follows:—

Variety.	Sown under a Corn Crop.	Sown Bare.
	Tons. cwt.	Tons. cwt.
Russian (Europe)	4 4	3 17
Canadian	3 14	3 12½
Provence	3 9½	3 9½
North American	3 9	3 9½
Russian (Asia)	3 2½	3 10½
American (Arizona)	2 1½	1 13
Turkestan	1 7¼	1 8½

As in 1912 and 1913, the highest yield was obtained with the Russian (Europe) variety, the Canadian coming next, and the Provence third. In 1912 and 1913 a higher yield was obtained from the plot on which only lucerne was sown, but in 1914 this difference disappeared.

Varieties of Linseed (*Woburn Field Expts.*, 1914; *Jour. Roy. Agric. Soc.*, 1914; *J. A. Voelcker, D.Sc.*).—Four kinds of linseed were sown on duplicate plots in 1914. La Plata yielded 20·3 bush. of seed and 14 cwt. of straw, Morocco 19·9 bush. of seed and 15¾ cwt. of straw, Steppe 15·1 bush. of seed and 17½ cwt. of straw, and White-flowering (Dutch) 12·2 bush. of seed and 21 cwt. of straw per acre. The averages of the

duplicate plots are given. The Morocco variety contained 39·47 per cent. of oil in the seed, La Plata 38·85 per cent., Steppe 37·88 per cent., and White-flowering (Dutch) 34·06 per cent. The White-flowering (Dutch) seed was subsequently found to have been of inferior quality, thus lessening the value of the comparison of it with the other varieties.

Varieties of Rye-grass (*Woburn Field Expts., 1914; Jour. Roy Agric. Soc., 1914; J. A. Voelcker, D.Sc.*).—Three varieties of rye-grass have been tested for three years, and the following yields of hay have been obtained (per acre) :—

Variety.	1912.	1913.	1914.
	Tons. cwt.	Tons. cwt.	Tons. cwt.
Pacey rye-grass ..	1 7	1 6¼	1 16¾
Dutch ,, ..	1 15¾	0 17	1 19¾
Italian ,, ..	2 11¾	0 19¾	2 5½

Germination of Mangolds (*Rept. on Field Expts. at Harper Adams Agric. Coll., 1914*).—A medium loam soil was treated with 15 tons of dung and, later on, 2 cwt. dissolved bones, 1 cwt. superphosphate and ¼ cwt. sulphate of ammonia per acre; 1 cwt. nitrate of soda was applied per acre as a top dressing. The variety of mangold was Sutton's Prizewinner. The treatment of the seed and the yields obtained were as follows (per acre) :—

	Tons. cwt.
Seed, ordinary form, 8 lb.	34 15
Seed, crushed, 8 lb.	35 0
,, 6 ,, ...	35 5
,, 4 ,, ...	33 15
Seed soaked 24 hours before sowing	35 0

All the methods of treatment retarded the germination of the plants at first, as compared with the untreated seed.

Top Dressing of Mangolds (*Rept. on Field Expts. at Harper Adams Agric. Coll., 1914*).—The field was on a heavy loam soil and received 2 cwt. dissolved bones, ½ cwt. sulphate of ammonia, and 1 cwt. superphosphate per acre at the time of sowing. The experiment was designed to test the values of different manures applied as a top dressing after singling. Sutton's Prizewinner was used, the seed being drilled at the rate of 7 lb. per acre. All the plots except Plot 1 received the standard dressing. The various top dressings, and the yields per acre were as follows :—

		Tons. cwt.
Plot 1.	No manure and no top dressing ..	20 17½
,, 2.	No top dressing	24 18¾
,, 3.	1 cwt. superphosphate	26 5
,, 4.	1 ,, nitrate of soda	27 2½
,, 5.	1 ,, nitrate of lime	25 5
,, 6.	1 ,, nitrolim	25 7½
,, 7.	1 ,, nitrate of ammonia	26 7½
,, 8.	1 ,, nitrate of soda	26 0

Manuring of Mangolds (*Rothamsted Expt. Sta., Ann. Rept. for 1914; E. J. Russell, D.Sc.*).—The addition of 220 lb. of nitrate of lime to a dressing of 12 tons of dung, 3 cwt. of superphosphate, ¾ cwt. of muriate of potash and ½ cwt. of salt per acre applied to mangolds gave considerably better results than the addition of either 175 lb. of nitrolim or 80 lb. of nitrate of ammonia per acre to the same dressing. Sulphate of manganese, at the rate of 35 lb. and 25 lb. per acre, when added to the above dressings caused a diminution in the crop in every case.

Varieties of Mangolds (*Rept. on Field Expts. at Harper Adams Agric. Coll.*, 1914).—A heavy loam soil was used for these trials, and 2 cwt. dissolved bones, 1 cwt. superphosphate, and ½ cwt. sulphate of ammonia per acre were applied before ridging, with 1 cwt. nitrate of soda per acre as a top dressing in July. The mangolds were drilled at the rate of 8 lb. per acre on 15th May.

The yields of the Yellow Globe varieties were :—Toogood's Masterpiece, 32 tons 12½ cwt. ; Sutton's Prizewinner, 30 tons 17½ cwt. ; Webb's Smithfield Yellow Globe, 30 tons 15 cwt. ; Garton's Large Yellow Globe, No. 15, 30 tons 12½ cwt. ; Dickson's Triumph Yellow Globe, 30 tons 7½ cwt. ; Clibran's Colossal Globe, 29 tons 15 cwt. ; Clibran's No. 1 Globe, 29 tons 15 cwt. ; Middlehurst's Prizetaker, 29 tons 12½ cwt. ; Sutton's Up-to-Date, 29 tons 7½ cwt. ; Dickson and Robinson's "Defiance," 28 tons 5 cwt. ; Garton's Large Yellow Globe, No. 28, 26 tons 7½ cwt. ; Garton's Large Yellow Globe, No. 53, 25 tons 17½ cwt. ; Little and Ballantyne's Prizewinner, 25 tons 15 cwt. ; Bromley's Special, 20 tons 10 cwt.

The yields of the Intermediate and Long varieties were :—Weibull's Excelsior Red, 33 tons 15 cwt. ; Weibull's Cylinder Barres, 30 tons 5 cwt. ; Sutton's Red Intermediate, 29 tons 12½ cwt. ; Dickson's Improved Red Intermediate, 29 tons 5 cwt. ; Webb's New Lion Intermediate, 29 tons ; Weibull's Särimner, 27 tons 17½ cwts. ; Weibull's Red Yellow Barres, 27 tons 7½ cwt. ; Dickson's Peerless Intermediate, 26 tons 2½ cwt. ; Weibull's Light Sugar Red Top, 25 tons 5 cwt. ; Dickson and Robinson's Red King, 25 tons ; Little and Ballantyne's Eclipse Intermediate, 25 tons.

Manuring of Potatoes (*Rothamsted Expt. Sta., Ann. Rept. for* 1914 ; *E. J. Russell, D.Sc.*).—Nitrate of ammonia, at the rate of 80 lb. per acre, when applied to the crop, together with 12 tons of dung, 3 cwt. of superphosphate and 1¼ cwt. of muriate of potash, proved more effective than either 175 lb. of nitrolim or 220 lb. of nitrate of lime applied similarly.

Manuring for Hay (*Rothamsted Expt. Sta., Ann. Rept. for* 1914 ; *E. J. Russell, D.Sc.*).—On the average, for the years 1856 to 1912, the best results have been obtained by the use of the following manures, the respective yields of hay being given in cwt. per acre :—Complete mineral manure + extra ammonium salts + silicate of soda, 73·3 cwt. ; complete mineral manure + extra amm. salts, 66·5 cwt. ; complete mineral manure + nitrate of soda (= 86 lb. N.), 56·9 cwt. ; complete mineral manure + amm. salts, 54·3 cwt. ; mineral manure (without potash) + amm. salts, 47·7 cwt. ; complete mineral manure + nitrate of soda (= 43 lb. N.), 46·3 cwt. ; complete mineral manure, 40·9 cwt.

DAIRYING.

Machine Milking (*Kentucky Agric. Expt. Sta., Bull.* 186).—Experiments with the "Sharples Mechanical Milker" at this Station are described. The machine cost £120, and the cost of the power, which is furnished by an electric motor, has averaged about £1 per month. Very little difficulty has been experienced in operating the machine.

There was no appreciable or permanent decrease in milk production during the short period in which the cows were made accustomed to the machine. Of a herd of 50 cows the decline in the milk yield in March, April and May was less with 25 animals that were machine milked than with 25 that were hand milked, compared with the February

yields, all cows being hand milked in that month. The effect of discontinuing machine milking after seven months for a few days was that some few cows gained slightly, but that most decreased slightly in milk yield. The last milk is always hand stripped.

As a general rule it has been found that two men can milk and strip, and feed 28 cows and carry their milk to the dairy room in 44 minutes; exceptionally, one man alone has carried out these operations in 1 hour 14 minutes.

The most satisfactory solution for cleaning the parts of the machine has been found to be 10 lb. slaked lime (lump) in 9 gallons of water.

In this machine outside air is not drawn into the bucket, so that it is difficult for the milk to become contaminated unless the cups fall to the floor or unless the machine were improperly cleaned; and bacteriological tests have confirmed this, very low bacterial counts being obtained.

Experiments in Churning (*Jour. Roy. Agric. Soc.*, 1913 and 1914).—Experiments were carried out in 1913 and 1914 with the milk of different breeds of cattle. Four lots of milk, each of 2 gallons, were taken for each of the breeds, one lot being scalded and the other three lots being separated. Of these separated lots the cream of one was churned sweet within three hours after separation; the cream of the second was allowed to ripen naturally after being kept for 24 hours in 1913 and 48 hours in 1914 and then churned; while the cream of the third was ripened with a starter and churned after 24 hours.

The results were as follows:—

Breed.	Butter.			
	Ripened with Starter.	Ripened Naturally.	Scalded Cream.	Sweet Cream.
1913—	lb. oz.	lb. oz.	lb. oz.	lb. oz.
Shorthorn ..	0 9½	0 8½	0 7¼	0 5
Holstein ..	0 9¼	0 8½	0 7½	0 5½
Jersey	0 15½	0 12½	0 12½	0 11¼
Dexter	0 10¼	0 11	0 8	0 9
1914—				
Shorthorn ..	0 10½	0 10¾	0 8	0 5½
Holstein ..	0 12½	0 12½	0 10	0 7¼
Devon	0 13½	0 13¼	0 10½	0 9½
Jersey	1 3½	1 1	0 14¾	0 12¼
Guernsey ..	0 14	0 14½	0 12½	0 8¼
Kerry	0 14½	0 14¾	0 10	0 9¾

LIVE STOCK AND FEEDING STUFFS.

Ricinus Poisoning (*Die Landw. Versuchs-Stat.*, Band lxxxv., Heft iii.-v.).—The following is a summary of a paper on poisoning by the seeds of the castor oil plant read by Kobert at the meeting of the Union of German Experiment Stations at the end of 1913.

There is only one species of Ricinus plant known to botany, viz., *Ricinus communis* L., but there are a number of varieties. All the varieties tested have proved poisonous, no matter what the size or colour of the seeds. The poison is contained in the shelled seeds and not in the shell, capsule, or oil extracted from the kernel. The substance

containing the poison is known as Ricin; it is not visible as such in the oil-free kernel; in quantity it forms only one per cent. of the dry, oil-extracted kernels. As, however, Ricin exceeds strychnine or arsenic in intensity, small quantities only of *Ricinus* seeds suffice to make a feeding stuff poisonous, a single gramme of the kernel mixed with several litres of milk having proved sufficient to poison a calf.

Castor oil seeds are introduced into feeding stuffs in various ways. In the first place the hedges of fields of ground-nut and sesame in the tropics are often of *Ricinus* plants and the seeds may thus get mixed with those of ground-nut or sesame at harvest. During transport, in storage, and in unloading there are again possibilities of castor oil seeds being mixed with other seeds. A further risk is run at the pressing factory where the machines may be badly cleaned after pressing the castor oil seeds, so that these become mixed with the next kind of seeds pressed. Again, for a soap making process in Germany the use of castor oil seeds is necessary, and there is the chance of their getting into animal foods owing to the amount of transport of these seeds that has to be carried on. Lastly, large quantities of the shells are sold at low prices to manufacturers of compound feeding-cakes who grind and use these shells in the cakes. As no method is known of completely freeing the shell from the kernel, it follows that these cakes must, as a rule, be poisonous, and on an average Kobert estimates that at least 1 per cent. of kernel matter will be present with the shell, an amount which is more than sufficient to cause fatal poisoning of cows when it is remembered that cakes are fed at the rate of from 2¼ up to 8¾ lb. per head per day. Farmers should refuse all such cakes, and merchants who resort to such practice are as guilty as if they included arsenic in their cakes.

The poison, Ricin, is an albumin and has the characteristics (1) of an albumin, (2) of a ferment or enzyme, (3) of a toxin, (4) of an agglutinin.

From the albumin nature of the poison it results that the mixture of Ricin with human or animal foods cannot be detected by purely chemical methods, even when one hundred times the fatal dose is contained in the foods; but the possibility of extracting the poison from foods by water or other method rests on the albumin nature of the poison.

The enzyme characteristics of the poison are useless for purposes of detection, since feeding cakes are always found to contain enzymes similar in effect to Ricin.

As regards its toxic effects immunity is reached by small, and gradually increasing, doses; and in the blood serum of immunised animals "antiricin," which has the effect of an antitoxin, is formed. This serum has been found extremely effective in the detection of extremely small quantities of ricin, but there is the drawback with this method that a different serum is produced in the case of some varieties.

The method of detection by injection into guinea-pigs and observing whether symptoms of super-sensitiveness are produced is not recommended by Kobert.

He lays stress, however, on the efficacy of a third method which rests on the agglutinin characteristics of the poison: *i.e.*, even if diluted to one millionth part of the original strength it coagulates the blood corpuscles of guinea pigs, and a substance like sealing wax is obtained on filtering. This method holds good for all varieties of *Ricinus* and is

even more sensitive than the serum test. Even here it must be remembered that "phasins" give a similar reaction. Ricin, however, will stand a temperature of 70°—75° C., while the only phasins that can be subjected to this temperature without being denatured are those present in *Phaseolus communis* and related indigenous legumes, and to detect these from ricin toxicological methods must be employed, *e.g.*, subcutaneous injections with rabbits.

The paper concludes with elaborate directions as to the conduct of tests for the detection of ricin in feeding stuffs.

Calf Rearing (*Jour. Roy. Agric. Soc.*, 1914; *J. A. Voelcker, D.Sc.*)—This experiment on the best way of rearing calves from birth was begun at the Woburn farm in the spring of 1912. An interim report on the experiment was summarised in this *Journal* for June, 1913, p.240, but the chief particulars are again given below together with an account of the final results.

Twenty bull calves (Shorthorns) were selected and purchased in the open market at the end of March, 1912, when they were two to three days old. They were all fed with whole milk *only* for the first three weeks, taking on the average one gallon per head daily. They were then divided into five lots, in order to test different foods. This part of the experiment lasted for nine weeks; the foods tested and the results were as follows:—

Food.	Cost per Calf per Week.	Gain per Calf per Week.	Cost per lb. Gain in Live Weight.
	s. d.	lb.	d.
1. *Cod-liver oil* and separated milk* ..	2 8·19	9·66	3·33
2. *Calf meal* (purchased) with whole and separated milk	2 0	8·66	2·77
3. *Gruel* (6 lb. fine oatmeal and 1 lb. linseed to 1 gall. water) and separated milk*	2 4·77	8·33	3·45
4. *Whole Milk*	5 9·22	12·83	5·39
5. *Crushed oats* (given dry) and separated milk*	2 9·61	13·30	2·52

* The separated milk was substituted gradually for the whole milk of the preliminary three weeks' feeding, the change being completed in three further weeks.

The crushed oats thus gave the highest gain in live weight and at the lowest cost per lb. of increase. The whole milk gave the next highest gain, but at a much increased cost.

The calves were next, at the age of twelve weeks, turned out into the yard and all fed alike with separated milk, a little linseed cake and crushed oats. On 14th July milk was discontinued and on 18th July the calves were turned out to run in the fields, being given linseed cake, crushed oats and hay. Throughout the winter of 1912-13 the calves were in the fields in the day-time and came into the yard at night when they had linseed cake with a little cotton cake, hay and sliced roots. During the spring, summer and early autumn of 1913 the bullocks were run out on the pastures and on 6th November, 1913, they were once more put up in the yards for fattening off. For the entire period from the close of the nine weeks of special feeding the animals were all treated exactly

alike and received the same foods; consequently such differences as were observable may fairly be attributed to the early feeding.

As they became fit for the butcher (viz., between February and May, 1914) the bullocks were sent off to be killed. The average gains per head daily in live weight during the several periods were as follows:—

Food.	16 April to 18 June, 1912.	18 June to 17 Sept., 1912.	17 Sept., 1912, to 5 Feb., 1913.	5 Feb. to 6 Nov., 1913.	6 Nov., 1913, to close.	Whole period.
	lb.	lb.	lb.	lb.	lb.	lb.
1. Cod-liver oil..	1·38	1·90	1·63	1·36	2·00	1·63
2. Calf meal ..	1·24	1·75	1·53	1·29	1·58	1·46
3. Gruel.. ..	1·19	1·57	2·01	1·30	1·68	1·55
4. Whole milk ..	1·83	2·00	1·90	1·37	1·72	1·66
5. Crushed oats	1·90	2·19	1·90	1·37	2·70	1·85

It is clear that the advantage gained in the early stages by feeding with crushed oats and separated milk, and similarly with whole milk alone, was never afterwards lost; and the important point is brought out that the early feeding has a most marked bearing on the after-development of the animal. The crushed oats animals were earliest to mature, followed by the whole milk and cod-liver oil lots.

The cost of feeding per head in each lot during the whole period, and the gain per head after selling were as follows:—

Food.	Special feeding from commencement including whole milk.	Subsequent feeding and grazing.	Total cost, reckoning cost of calf at £2 6s. 0d.	Price realised at 5s. per 8 lb. stone.	Gain.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1. Cod-liver oil	1 16 8	7 15 4	11 18 0	20 10 4	8 12 4
2. Calf meal ..	1 10 6	10 3 4	13 19 10	20 15 4	6 15 6
3. Gruel ..	1 14 1½	9 18 11½	13 19 1	21 1 3	7 2 2
4. Whole milk	3 4 5	8 6 6	13 16 11	21 13 1	7 16 2
5. Crushed oats	1 17 9	8 2 9	12 6 6	23 0 5	10 13 11

This table again shows the marked superiority of the "crushed oats" feeding, the highest price and the highest gain being obtained with this food. The "whole milk" fed animals realised the second highest price, but the cost of feeding was greater, and the "cod-liver oil" lot stood second as regards final money returns.

Manurial and Feeding Value of Some Common Weeds (*Landw. Versuchs-Stat.* Band lxxxv., Heft vi.).—The composition of six weeds, viz., Bindweed (*Convolvulus arvensis*), Goosefoot (*Chenopodium album*), Chickweed (*Stellaria media*), Field Thistle (*Cirsium arvense*), Annual Sow Thistle (*Sonchus oleraceus*), and Annual Mercury (*Mercurialis annua*) was investigated. It is clear that these weeds abstract large quantities of plant nutrients from the soil; in their dry matter were found 2·77–4·45 per cent. of nitrogen, 0·85–2·01 per cent. of phosphoric acid, 4·91–11·78 per cent. of potash and 1·03–5·30 per cent. of

lime. Care must, therefore, be taken that these nutrients are not lost but placed at the disposal of cultivated plants. Weeds are best combated by hoeing.

Where it is not possible to keep down weeds, there is nothing to prevent their being used as feeding stuffs, provided that only those weeds are fed which are known to have good effects. For this purpose the plants must not be cut too near the ground, or too much earth will get into the food.

All the weeds examined, except Annual Mercury, have proved good as green fodder, and not the slightest harm has resulted from feeding them, especially to dairy cows. Bindweed had the highest feeding value. In the fresh condition these weeds did not attain the feeding value of red clover and lucerne; but in the dry condition they had a higher value than these two plants. Care should be taken that they are fed before they reach the seeding stage.

Annual Mercury is not readily eaten by animals, and injuriously affects their health, so that in spite of its high nutritive value it should, if possible, be excluded and used as manure.

In view of their content of plant nutrients, all the above weeds might be put to manurial use; but they should not be so used after they reach the seeding stage.

Effect of Storage on the Composition and Digestibility of Hay (*Landw. Versuchs-Stat.*, Band 84, 1914).—The investigations referred to the composition and digestibility of meadow hay kept for three years and of clover hay kept for two years in well ventilated storage; no changes were found to result in either composition or digestibility as a result of the storage. It is thought by the experimenters that the depreciation in hay on storage shown by other investigators must have been due to mechanical losses.

WEEDS AND PLANT PESTS.

Celery Leaf-spot (*Jour. Roy. Hort. Soc.*, April, 1915; *G. H. Pethybridge, B.Sc., Ph.D.*).—It is stated that there is little doubt that the spread of this disease has occurred mainly through the employment of infected celery seed.

To combat the disease three methods must be employed: (1) All celery seeds should be examined by a competent mycologist, and if necessary they should be treated with an appropriate germicide (see this *Journal*, July, 1914, p. 342). The onus of providing disease-free seed should be placed on the seed grower. (2) If the disease appears it should be kept in check by spraying the plants with Bordeaux mixture, in a somewhat similar manner to that adopted for checking potato blight (see Leaflet 238). (3) All diseased portions of the plants should be most carefully collected and burned, and in no circumstances should they be allowed to remain in or on the soil, or to reach the manure or compost heap.

A disease discovered on wild celery seemed to be identical with leaf-spot of cultivated celery, and it is thought that the original source of the disease is to be looked for in the parasite occurring on the wild plant.

Iris Leaf-blotch Disease (*Jour. Roy. Hort. Soc.*, April, 1915; *J. K. Ramsbottom*).—This disease (*Heterosporium gracile*) occurs on many

different species. The affected leaf fades much before the normal time, and, apart from an unsightly appearance resulting, the storage of food reserves for the next season's growth is hindered.

The fungus can pass through the winter in its fruiting form, and the spores are capable of germination even after 24° F. of frost; the other parts of the fungus are capable of regeneration and thus of forming a new centre for the spread of the disease.

All old leaves should be gathered and burned. A dressing of slaked lime put on in autumn and lightly forked in in spring has been found efficacious in eradicating the disease. Further, it would seem that the disease particularly affects lime-loving species when the soil is deficient in lime, but not lime-hating species.

Successful attempts were made to inoculate living plants with cultures of the spores. An attempt to inoculate Narcissus failed.

Wart Disease of Potatoes (*Third Rept. of Bd. of Agric. for Scotland*).—The varieties Isis, Irish Queen, and Great Scot were found to be resistant to wart disease in experiments in sixteen severely infected gardens. In every instance the variety Up-to-Date was severely attacked by the disease.

Salt, formalin and calcium carbide, applied to the soil a short time before the potatoes were planted, each considerably reduced the yield of the crop with no corresponding diminution of wart disease.

American Gooseberry Mildew (*Third Rept. of Bd. of Agric. for Scotland*).—It is stated that, judging by the observations carried out by the Inspectors of the Board of Agriculture for Scotland, there can be little question that spraying during the period of growth, followed by careful pruning and burning of all diseased wood as soon as growth has ceased for the season is a more effective method of controlling the disease than summer tipping without spraying.

MISCELLANEOUS.

Germination Test for Seeds (*Abs. in Jour. of Ecology*, March, 1915).—A method different from that ordinarily in use for testing vitality of seeds is required when a considerable period elapses before conditions favourable to germination occur; and in this investigation differences in the amounts of heat liberated by seeds were used for estimating age and germinating capacity. The heat given off and the germinating capacity decrease with increasing age; and the younger seeds respond most quickly to the influence of conditions favourable to germination, reaching the maximum percentage of germination and the maximum temperature sooner than older seeds. Germinating seeds have "characteristic" temperatures; and if the seed under test has a temperature removed from the characteristic temperature for the species, and if within a reasonable time (varying with the species) there is no rise in temperature or a rise which does not indicate the characteristic temperature, then the seed will not germinate.

Natural and Artificial Drying of Grass (*Landw. Versuchs-Stat.*, Band LXXXVI., Heft III. und IV.; *F. Honcamp*).—The common method of drying grass into hay in the open, and by exposure to the sun, was found to lead to loss of crude and digestible nutrients in the grass, quite apart from mechanical losses. All the nutrients were affected, but the loss occurred especially in the fat, both as regards absolute amount, and digestibility.

On the other hand, with proper precautions, and at low temperatures, it was found that artificial drying of the grass did not lead to any significant loss either of crude or digestible nutrients. Artificial drying of grass by hot gases as carried out in the ordinary drying apparatus in use in Germany was, however, always found to lead to a considerable decrease in the digestibility of the protein.

NOTES ON AGRICULTURAL CO-OPERATION.

The Land and Agricultural Bank of South Africa.*

THE Land and Agricultural Bank of South Africa was established by an Act of the Union Parliament, and came into existence on 1st October, 1912, on which date it took over the assets and liabilities of the Transvaal Land Bank and the Agricultural Loan Funds of the Orange Free State and Natal.

The main object of the Bank is "to assist the farming population by providing *bona fide* and deserving applicants with funds at a cheap rate, repayable in instalments over an extended period."

The control of the Bank is in the hands of a Central Board, with offices at Pretoria. This Central Board deals directly with the business of the Transvaal area, while local boards have been established for Natal, the Orange Free State, Eastern Cape Colony, and Western Cape Colony.

The magistrates of the Union are the agents of the Bank, which is largely dependent upon them, on the one hand, for information as to the character of each applicant for a loan, and the value of the security offered, and, on the other hand, for making known to the farmers the various kinds of advances which the Bank is authorised to make.

The minimum amount which may be lent to any one farmer is £50, and the maximum amount ordinarily £2,000, and exceptionally £5,000.

Each application for an advance must be accompanied by a valuation of the property offered as security, made by a valuer appointed by the Central Board; the cost of making the valuation is regulated by a scale of charges and falls upon the applicant. The security for loans is normally a first mortgage on land or farm buildings, and advances may be made up to 60 per cent. of the value of the security offered.

The advances are made for thirty years; during the first five years interest is paid at the rate of 5 per cent., and the borrower has the privilege of reducing the amount of the loan by repayments of £5, or any multiple of such sum, at any date upon which interest is due. At the end of five years the principal sum outstanding becomes repayable in twenty-five years in half-yearly instalments.

Besides the above "ordinary" loans, the following (among other) "extraordinary" advances may be made: (1) Cash credits to farmers for short periods for an amount not exceeding £1,000; (2) Advances for the construction of fences and dipping tanks; and (3) Advances to approved co-operative societies.

* Summarised from the *Monthly Bulletin of Economic and Social Intelligence*, International Institute of Agriculture, October, 1914, and April, 1915.

The last-named advances are guaranteed by the joint and several liability of all the members, while, as an additional security, the Bank has power to inspect the books of the society for the purpose of ascertaining whether the funds advanced are being carefully and economically expended for the proper purposes.

These purposes are especially :—

(1) The erection of buildings and the purchase of

(*a*) Immovable property.

(*b*) Agricultural machinery to be worked on behalf of members.

(*c*) Breeding stock to be controlled and used on behalf of members.

(*d*) Plant, office furniture, and other equipment.

(2) To make advances to members against produce, actually delivered to a society in good order and condition, and carefully graded.

(3) To purchase grain bags, agricultural implements, seeds, and farming requisites to be supplied to members.

Operations from 1st October, 1912, to 31st December, 1912.—In this period the number of applications for ordinary advances, which were approved, was 547, to the amount of £348,220 ; the number of advances actually paid out was 287, to the amount of £106,840 (*i.e.*, £372 on the average), and secured by farm property to the value of £265,521. The purposes for which these advances were made were : For improvements, £20,124 ; for purchase of stock, £14,622 ; for discharge of existing liabilities, £49,142 ; for sub-division of land, £172 ; and for purchase of land, £22,780.

The profit made by the Bank in the period was £8,674, which, added to the reserve funds taken over from the Transvaal Land Bank and the Land and Agricultural Loan Funds of the Orange Free State and Natal, brought the reserve fund of the Bank at the end of 1912 to £88,160.

Operations during 1913.—The demand during 1913 for the benefits offered by the Bank was so much beyond expectations that the funds placed at the disposal of the Central Board proved quite inadequate, and the Board could only continue to make advances after securing a large overdraft from its bankers, and an additional grant of £25,000 from the Government. The issue of stricter regulations as to the purposes for which loans could be granted failed to lessen the rate at which applications for advances increased, and the maximum amount of loans was, therefore, reduced to £500.

The Board estimated that it would require a further vote of £439,000 for the year ending 31st March, 1914, and one of £1,435,000 for the year ending 31st March, 1915, unless the maximum amount of the loan of £2,000 were permanently lowered, and it was loath to advocate this way out of the difficulty, as any such reduction would defeat the purposes for which the Bank was created.

During 1913, 2,636 " ordinary " advances were made to the amount of £1,530,060 (average £584), and against security of the value of £3,418,670. The purposes for which the loans were granted were for : Improvements, £216,270 ; purchase of stock, £125,335 ; discharge of existing liabilities, £662,118 ; and purchase of land, £525,972.

Of the " extraordinary " advances £60,246 was granted in respect of dipping tanks (though not paid out in full), £102,195 was paid for fencing construction, and advances of £55,000 were made to three co-operative societies.

THE history and working of a successful fruit growers' association in Kansas is given in the *Report of the Kansas State Board of Agriculture* for 1913–14.

A Successful American Fruit Growers' Association.

Previous to the formation of the Association fruit growing in the district (Wathena) had become unremunerative owing mainly to the irregularity with which the supplies of fruit were despatched; on one day many growers would pick and the produce would have to be despatched on account of its perishability and the market would be glutted; while on other occasions during the season orders could not be carried out because so little fruit was picked.

A meeting of 150 growers which discussed the problem decided that the organisation of the whole of their supplies would be too difficult a task. Twelve of these growers, however, proceeded to organise themselves into the "Wathena Fruit Growers' Association" by subscribing capital to the value of £250 in twelve equal shares. The first year was a success, and the efforts of some firms in the fruit trade to "break" the Association failed.

At present, after nine years' work, the Association numbers 150 members. Every person desirous of becoming a member must be a fruit grower, must contribute a membership fee of £2 2*s*. and buy at least one share of £1 1*s*., each share carrying one vote. The Association's property, consisting of warehouses, forwarding sheds and office, is valued at £4,170; the warehouses are near the railway yards and are equipped with the best forwarding facilities.

There are no restrictions imposed on the growers in regard to their methods of cultivation; but all fruit must be packed in the fields, and all (except apples) must be delivered to the Association in spring waggons. To induce the growers to bring in their fruit early in the day a reduction in price is made on fruit delivered late. All the produce is inspected and any not coming up to standard rejected; there is only one grade of fruit, the standard being high. When the fruit has been passed by the inspector the stamp of the Association is put on it and the grower is given a ticket, showing the kind, quantity and value of the fruit, and which, when presented at the office of the Association, entitles the grower to the amount shown thereon. The price paid varies from day to day, and is the price paid to growers by firms in the fruit trade.

At the end of the year the profit or loss in marketing is pro-rated among the members according to the amount of fruit forwarded through the Association. The accounts of each kind of fruit are kept separate; for instance, strawberries bear their own losses or profits.

While members cannot be compelled to market all their fruit through the Association, on account of the anti-trust laws, they are morally bound to do so, and there are few, if any, who do not. Rarely is any difficulty experienced in disposing of the produce. The Association enjoys a wide reputation, despite the fact that the only advertising done is the despatch of circular letters or post cards to regular customers quoting prices for the fruit being marketed.

Very little fruit is consigned, most of it being sold by wire f.o.r. on the railway waggon at Wathena. Any losses during transit of waggon-load lots are made good by the Association and recovered from the railway or other forwarding company. The distribution of the fruit to the various markets is not a matter of much importance to the Association as it is principally the business of the firms who are the

customers of the Association. A close scrutiny of prices all over the country is made by the manager of the Association in order to secure the marketing of the fruit to the best possible advantage. The annual business of the Association is possibly of the value of £60,000.

All materials for making crates and preparing sprays are bought through the Association at a saving of about 20 per cent. Post cards are sent to each member requesting that he inform the manager of the number of crates, baskets and barrels he will need. The amounts are summarised and all the manufacturers of such material are asked for bids for the whole for December or January delivery. It is estimated that, compared with a neighbouring horticultual society, the members of this Association have saved £4,200 in seven years on the purchase of this material.

As regards staff, the manager is employed throughout the year at a stated salary. In addition, the Association engages additional help during the forwarding season (May to November) consisting of two bookkeepers, one forwarding clerk, one inspector and an assistant. The total sales and office expenses amount to about £730 a year on the average.

Co-operative Agricultural Credit in the Punjab.

ARTICLES on co-operative agricultural credit in India as a whole have appeared in this *Journal* for February 1913, p. 947, and January 1914, p. 922. An account of the movement dealing with the Punjab only, and going into some detail, is contributed by Sir James Douie, K.C.S.I., to the June, 1915, issue of *Co-operation*.

It is pointed out that the Punjab is as large as England, Scotland and Wales, has a population of twenty million souls, and is an agricultural country mainly owned, and to a large extent cultivated, by small peasant landowners. In the plains an average sized holding occupies an area of six or seven acres. Village banks were started ten years ago as one means of counteracting the great, and at that time growing, evil of agricultural debt.

The following figures show how remarkable has been the progress made :—

Year.	Societies.	Members.	Working Capital.
			£
1905-6 ..	23	1,203	2,840
1906-7 ..	177	17,533	20,127
1907-8 ..	258	21,881	30,081
1908-9 ..	316	23,429	59,436
1909-10 ..	706	38,604	124,200
1910-11 ..	1,088	61,423	245,673
1911-12 ..	1,769	93,169	488,128
1912-13 ..	2,845	133,780	720,627
1913-14 ..	3,333	160,892	1,228,660

A proof of the solidity of the foundations on which the movement rests is shown by the fact that it was very little affected by a financial crisis among joint stock banks in towns in 1913-14, when many of the latter closed their doors.

Of the societies shown in the above statement 38 with a working capital of £284,662 are either Central Banks (18) or Unions (20) whose chief business is the financing of village banks. As the former develop, the latter will probably cease to advance money, and confine themselves

to the business of inspection and control. Only village societies can hold shares in Unions. The older Central Banks pay dividends of from 6 to 12 per cent. They pay 6 per cent. interest on deposits, and charge 8 per cent. on loans to societies. They received during the year 1913-14 £103,659 in deposits as against £67,042 withdrawn. The Unions are in many cases partly financed by the Bank of Bengal.

The deposit business of the 3,261 agricultural village banks was somewhat affected by the financial crisis. There was a shrinkage in receipts and a large increase in withdrawals, as the following figures prove :—

	1912-13.	1913-14.
	£	£
Received	162,622 ..	121,441
Withdrawals ..	70,613 ..	106,210

The usual rate of interest on deposits is 6 per cent. Members pay 12½ per cent. interest on loans, but it must be remembered that a man who had to pay the moneylender 18, 24, or 36 per cent. is glad to get money on such comparatively easy terms. The societies have share capital, but at present no dividends are payable, and it is hoped that this restriction will become permanent, or at any rate will be maintained till the growth of working capital enables them to lower the rate of interest on loans. £480,381 were advanced to members and £40,813 to other societies during the year.

Each village society now consists on the average of 47 members. The actual funds of which they have the handling are estimated at £776,666, made up of

	Per Cent.
Share Capital	27
Interest received	8
Deposits by Members	15
Loans and Deposits by Non-members ..	16½
Loans from Central Societies	33
Loans from Government	½

Thus half of the working capital is supplied by the members themselves, and the Government's share in financing the societies, which becomes less year by year, is now a negligible quantity.

A rough classification of the purposes for which loans are taken, compiled from figures supplied by 14 districts, may be of interest.

	Per Cent.
Payment of Land Revenue	21
Purchase of Cattle	20
Payment of Debts and Mortgages	17
Household Expenses	16
Purchase of Seed and Fodder	15
Other purposes	13

In the single district of Jalandhar, where the village bank has become an exceedingly popular institution, £65,121 have been advanced since the movement started, to pay off unsecured debts, and £24,360 to release from mortgage 5,450 acres of land.

The profit earned during the year 1913-14 was £11,038, which amounts to 20 per cent. on the share capital, but, as already noted, no dividends are at present paid. The management expenses were only £1,243.

The Government has made itself responsible for audit and inspection. Given the local conditions this was, and will probably long continue to be, a condition of successful working. The discreditable history of many of the joint stock town banks in India has shown that State

supervision, and help to organise new societies, is essential. But the cost of the inspecting staff is being met more and more by the societies themselves, and the expenditure on the Government-paid staff, exclusive of the Registrar and Assistant Registrar, who are members of the Indian Civil Service, only works out at sixteen shillings per society.

Suggestions from America for Co-operative Selling.

In connection with the article on this subject, which was published in this *Journal* for June, 1915, p. 201, it should have been acknowledged that the illustrations of specimens of American brands (Fig. 3) were reproduced from *The Country Gentleman* (Philadelphia, U.S.A.) with the kind permission of the editor of that Journal.

Monographs on Agricultural Co-operation. Vol. II.

The International Institute of Agriculture has issued Vol. II. of its series of Monographs on Agricultural Co-operation in various countries. This volume deals with Argentina, Austria, Hungary, Italy, and Switzerland. The Board have made arrangements to supply copies (in English) of this publication at the price of 2*s.* 9*d.* each post free. Applications, with remittances, should be addressed to the Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W.

OFFICIAL NOTICES AND CIRCULARS.

Slaughter of Animals Order of 1915.

The Board of Agriculture and Fisheries have, under the Slaughter of Animals Order of 1915 (dated 22nd June, 1915), prohibited the slaughter of

(*a*) Animals which are visibly or obviously in-calf or in-pig; and

(*b*) Calves under the age of twelve weeks, except male calves of Channel Island, Ayrshire and Kerry breeds.

The restrictions do not apply to

(*a*) Slaughter of an animal under the powers conferred by the Diseases of Animals Acts, 1894 to 1914, or any Order made thereunder; or

(*b*) Slaughter of an animal necessary or desirable on account of accidental injury to the animal or its illness; or

(*c*) Slaughter of an animal if in the opinion of the Board of Agriculture and Fisheries the slaughter is desirable for any exceptional reason or purpose and the slaughter is authorised by a licence granted by that Board or an officer of that Board.

Any contravention or failure to comply with the Order renders the offender liable to a fine of twenty pounds, or if the offence relates to more than four animals to a fine of five pounds for each animal.

Committee on Home Production of Food.

The President of the Board of Agriculture and Fisheries appointed on 17th June a Departmental Committee to consider and report what steps should be taken by legislation or otherwise for the sole purpose of maintaining and, if possible, increasing the present production of food in England and Wales, on the assumption that the war may be prolonged beyond the harvest of 1916. The Committee is constituted as follows:—

The Rt. Hon. Viscount Milner, G.C.B., G.C.M.G. (*Chairman*).
The Lord Inchcape, G.C.M.G., K.C.S.I.
The Rt. Hon. Francis D. Acland, M.P.
Mr. Charles W. Fielding.
Mr. A. D. Hall, M.A., F.R.S.
Mr. Rowland E. Prothero, M.P.
Mr. J. A. Seddon.
The Hon. E. G. Strutt, and
Sir Harry C. W. Verney, Bart., M.P.

The Secretary of the Committee is Mr. H. L. French, of the Board of Agriculture and Fisheries, to whom all communications should be sent.

The Committee has been appointed for the specific purpose defined in its terms of reference, and it has been asked, should it find that additional powers are necessary, to report in time for legislation to be submitted to Parliament during the present Session. Its functions are quite distinct from those of the Agricultural Consultative Committee appointed by Lord Lucas on the outbreak of war. The Consultative Committee is a permanent Committee to which the Board refer many subjects connected with practical agriculture, and no alteration in its work or constitution is contemplated; it will continue to advise the Board throughout the duration of the war.

Consumption of Old Potatoes.

THE President of the Board of Agriculture and Fisheries desires to call attention to the fact that there is a considerable supply of last year's crop of potatoes remaining unconsumed. At this season there is a general demand for new potatoes, and these, although they are undersized because of the dry weather, are already being disposed of in great quantities. This is a waste of the national resources, since most of the new potatoes if left in the ground would increase considerably in weight. Consumers are therefore urged to make use of the remainder of last year's potato crop before making large demands upon the new one.

Employment of Soldiers for Hay-making.

THE Board of Agriculture and Fisheries were informed by the Army Council early in June that in view of the possible shortage of agricultural labour for the hay harvest, furlough will be given, at the discretion of the Military Authorities, to a limited number of soldiers of the New Armies and of the Territorial Force for work in the hay harvest as circumstances may permit.

The furlough granted to each soldier will last only for such number of days, not exceeding fourteen, as he is actually required for hay-making.

The employment of soldiers in the hay harvest will be subject to the following conditions:—

1. That suitable labour cannot be obtained in the locality.
2. That the farmer will undertake to pay each soldier sent at his request:—
   (*a*) 4*s.* a day if the soldier provides his own board and lodging.
   (*b*) 2*s.* 6*d.* a day if board and lodging is provided by the farmer.
3. That the farmer will provide conveyance from and to the nearest railway station.

No charge will be made to the farmer for railway travelling expenses.

Every endeavour will be made to ensure that the men released have been accustomed to farm work, but no guarantee to this effect can be given.

The above arrangements will not apply to the corn harvest, in respect of which fresh regulations will be issued.

Applications from farmers who desire to employ soldiers in the hay harvest must be made as soon as possible to the Board of Trade Labour Exchanges, when the application will be transmitted to the Military Authorities. Forms for the purpose are obtainable from the Local Labour Exchange, the address of which can be obtained from the nearest Post Office.

Indian Wheat Committee: Reappointment.

THE President of the Board of Agriculture and Fisheries has re-appointed, as follows, the Indian Wheat Committee, appointed by his predecessor, to supervise the arrangements in this country connected with the scheme introduced by a notification of the Government of India, dated 25th March, 1915, for the shipment of wheat from India to the United Kingdom on Government account.

The Rt. Hon. F. D. Acland, M.P. (Parliamentary Secretary to the Board of Agriculture and Fisheries) (*Chairman*).
Mr. R. H. Rew, C.B. (Board of Agriculture and Fisheries) (*Deputy-Chairman*).
Mr. J. M. Keynes (H.M. Treasury).
Sir George Saltmarsh (The Baltic).
Sir Lionel Abrahams, K.C.B. (India Office).
Mr. T. H. Middleton, C.B. (Board of Agriculture and Fisheries).
Mr. J. A. Hubback (India Office).
Mr. H. D. Vigor (Board of Agriculture and Fisheries) (*Secretary*).

Ensilage: Special Notice to Farmers.

THE prolonged spell of dry weather has affected both the hay and root crops, and in view of the reduction in yield and the increased demand for hay and fodder next winter the Board of Agriculture and Fisheries wish to draw the attention of farmers to ensilage. This system of storing fodder in the green state is well known, and silage has an established reputation as a food for stock; but under present circumstances it has two special advantages. Ensilage affords a safeguard against waste should the autumn prove too wet for harvesting late hay crops, and it provides, in silage, a form of green food which makes a very good substitute for roots.

In many cases hay aftermath might be converted into silage. When the aftermath is grassy a top dressing of ¾ cwt. sulphate of ammonia or other quick acting nitrogenous manure would be useful. It is not too late to sow crops for silage purposes in July and August. A mixture such as vetches, oats, and a little rape would make good silage, and prove an effective "smother" crop if sown early in July on land where roots may have failed because of drought. If the stubbles are broken up as soon as the corn is in stock and sown with white mustard or rape useful crops for filling the silo may be expected.

The main essential in making silage is compression, to exclude air, and this object is usually best attained when the silage crops are cut while still in the immature condition and carted soon afterwards.

Silage is now generally made in Stave Silos or in stacks. The Stave Silo which is widely used in the United States has been successfully tried in some parts of England. It entails less waste than the stack,

and needs no artificial weighting; the fodder is chaffed before being stored, and the greater depth of the silo as compared with its diameter ensures sufficient compression. On the other hand, a stack saves the initial cost of a silo, and may be erected in any convenient position. Full particulars as to the making of silage will be found in Leaflet No. 9 (*Ensilage*), copies of which may be obtained free of charge, and post free, on application to the Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W. Letters or post cards of application so addressed need not be stamped.

Leaflets in 1915.

SINCE the date of the list given on p. 951 of the *Journal* for January last the following leaflets have been issued in the ordinary series:—

No. 282.—*Schemes for Improvement of Live Stock*; and

No. 290.—*The Cattle Testing Station of the Board of Agriculture and Fisheries.*

In addition, the information given in the following leaflets has been revised and brought up to date:—

No. 4. *Winter Moths.*—The section "methods of control" has been completely revised.

No. 30. *Codling Moth.*—This leaflet has been entirely re-written, and brought up to date.

No. 44. *The Lapwing, Green Plover, or Peewit.*—The leaflet has been re-written, and a table added showing the times of the year during which the eggs of the lapwing are protected in different counties and boroughs.

No. 75. *Root-knot Disease of Cucumbers and Tomatoes.*

No. 96. *Milk Fever or Parturient Apoplexy.*

No. 170. *The Use of Lime in Agriculture.*—This leaflet has been considerably revised. Attention is now drawn to the value of ground limestone as a source of lime.

No. 179. *The Making of Soft and Cream Cheeses and Clotted Cream.*

No. 208. *Larch Shoot Moths.*—This leaflet has been re-written.

No. 244. *The Destruction of Rats.*

Sheep Grazing on Golf Links.

WITH reference to the note published in this *Journal* for May, 1915, p. 177, containing a suggestion by the Acting Secretary of the Sunningdale Golf Club to the effect that many of the golf links in this country might be more extensively employed for grazing sheep, it is satisfactory to note that, out of some hundred communications on the subject addressed by golf clubs to the Board, in the vast majority of cases it was stated that the grazing was already let for sheep (or even cows and ponies) and that in practically every case where the land was not so let, arrangements were being made for the purpose. In several cases the Board were informed that the grass on the links was cut for hay.

Produce of Crops in England and Wales, 1914.

PART II. of the Agricultural Statistics for 1914 (Cd. 7954, price 3½*d.*) giving returns of the produce of crops in England and Wales in 1914, with summaries for the United Kingdom, has been recently issued by the Board. An interesting feature is the inclusion of a summary of reports received from the Board's crop reporters on the conditions affecting crops and live stock, and the course of farming operations during the "harvest" year 1913-14 in each group of counties in England and Wales.

Report of the Commercial Control Branch for 1914.

THE Report for 1914 of the Commercial Control Branch of the Board of Agriculture and Fisheries [Cd. 7935, price 3*d*.] contains an account of the work accomplished during 1914 with regard to the administration of the Sale of Food and Drugs Acts, 1875-1907; the administration of the Fertilisers and Feeding Stuffs Act, 1906; prosecutions under the Merchandise Marks Acts, 1887 to 1894; and questions as to the transport and marketing of agricultural produce and the produce of any fishing industry.

MISCELLANEOUS NOTES.

The Increasing Wages of Agricultural Labourers.

FREQUENT reference to the increasing wages of agricultural labourers has been made in past issues of this *Journal*, but in view of the interest of the question at the present time no apology is needed for again alluding to the subject.

The note in this *Journal* for November, 1914, p. 759, gave particulars of the movement of agricultural wages in 1913. The Board of Trade have now obtained returns (*Board of Trade Labour Gazette*, June, 1915) showing the changes which took place in the rates of cash wages in 1914, and also changes made this year up to the latter part of April. The returns cover over 90 per cent. of the rural districts.

Changes in 1914.—The results obtained by combining the changes in wages in 1914 with the estimated total number of agricultural labourers of all classes in the rural districts affected are shown in the following table, comparative figures being added for each year from 1896, the earliest year for which statistics have been compiled :—

Year.	Estimated Number of Men affected.			Computed amount of Change in Weekly Cash Wages, comparing each Year with the previous Year.		
	By Increases.	By Decreases.	Total.	Increases.	Decreases.	Net Inc. (+) or Dec. (—).
				£	£	£
1896 ..	52,771	36,676	89,447	1,858	1,513	+ 345
1897 ..	72,559	4,340	76,899	2,232	110	+ 2,122
1898 ..	183,987	2,356	186,343	6,227	47	+ 6,180
1899 ..	163,960	208	164,168	5,438	4	+ 5,434
1900 ..	230,635	—	230,635	8,150	—	+ 8,150
1901 ..	127,565	10,469	138,034	3,559	398	+ 3,161
1902 ..	51,949	41,705	93,654	1,609	1,297	+ 312
1903 ..	51,095	24,953	76,048	1,449	893	+ 556
1904 ..	23,779	9,569	33,348	1,032	451	+ 581
1905 ..	6,659	12,438	19,097	252	442	— 190
1906 ..	14,758	8,744	23,502	704	322	+ 382
1907 ..	14,971	3,439	18,410	479	103	+ 376
1908 ..	40,134	13,780	53,914	1,411	684	+ 727
1909 ..	29,244	19,772	49,016	747	451	+ 296
1910 ..	15,451	271	15,722	794	22	+ 772
1911 ..	25,427	4,360	29,787	1,214	270	+ 944
1912 ..	102,602	1,846	104,448	5,383	92	+ 5,291
1913 ..	182,040	641	182,681	9,996	32	+ 9,964
1914 ..	242,047	—	242,047	19,337	—	+ 19,337

It will be seen that there was a very marked increase in wages in 1914, the aggregate weekly amount by which wages increased being nearly twice as large as in 1913, and equal to the accumulated net increase of the ten years 1904-13. The majority of the increases took place in the autumn (*i.e.*, after the outbreak of war), at which season the scarcity of labour previously existing became more or less accentuated in many districts, largely as the result of recruiting for the Army. No decreases in ordinary labourers' wages were reported.

The counties showing over 75 per cent. of the total number of labourers as being affected by advances in cash wages were Cumberland, Westmorland, East and West Ridings of Yorkshire, Leicestershire, Derbyshire, Gloucestershire, Shropshire, Northamptonshire, Huntingdonshire, Norfolk, Berkshire, Denbighshire, and Montgomeryshire.

The usual amount of increase in 1914 in rural districts in which advances took place varied from 1*s.* to 3*s.* per week, but in a number of rural districts some of the labourers received more than 3*s.* The increases were distributed as follows among the labourers estimated

Predominant Amount of Increase in Wages since July, 1914.

County.	Predominant limits of Increase in Wages up to April, 1915, since July, 1914.
Northern Counties :—	
Northumberland ..	1*s.* to 3*s.*
Durham	1*s.* ,, 4*s.*
Cumberland	1*s.* ,, 2*s.*
Westmorland ..	1*s.* ,, 2*s.*
Yorkshire, Lancashire and Cheshire :—	
Yorkshire	1*s.* ,, 4*s.*
Lancashire	1*s.* ,, 3*s.*
Cheshire	1*s.* ,, 3*s.*
North and West Midland Counties :—	
Leicestershire ..	1*s.* ,, 3*s.*
Rutland	About 1*s.*
Lincolnshire	1*s.* to 3*s.* 6*d.*
Nottinghamshire ..	2*s.* to 3*s.*
Derbyshire	2*s.* ,, 4*s.*
Gloucestershire ..	1*s.* ,, 2*s.*
Herefordshire ..	2*s.* ,, 3*s.*
Shropshire	2*s.* ,, 4*s.*
Staffordshire ..	1*s.* ,, 3*s.*
Worcestershire ..	1*s.* ,, 2*s.*
Warwickshire ..	1*s.* ,, 3*s.*
South Midland and Eastern Counties :—	
Middlesex	2*s.* ,, 3*s.*
Hertfordshire ..	1*s.* ,, 3*s.*
Buckinghamshire ..	1*s.* ,, 2*s.*
Oxfordshire	1*s.* ,, 3*s.*
Northamptonshire ..	1*s.* ,, 3*s.*
Huntingdonshire ..	2*s.* ,, 3*s.*
Bedfordshire	1*s.* ,, 2*s.*
Cambridgeshire ..	2*s.* ,, 3*s.*
Essex..	1*s.* ,, 3*s.*
South Midland and Eastern Counties— *continued.*	
Suffolk	2*s.* to 3*s.*
Norfolk	2*s.* ,, 3*s.*
South Eastern Counties :—	
Surrey	1*s.* ,, 2*s.*
Kent	1*s.* ,, 3*s.*
Sussex	1*s.* ,, 3*s.*
Hampshire	Up ,, 4*s.*
Berkshire	2*s.* ,, 4*s.*
South Western Counties :—	
Wiltshire	2*s.* ,, 4*s.*
Dorset	2*s.* ,, 3*s.*
Devonshire	1*s.* ,, 3*s.*
Cornwall	1*s.* ,, 2*s.*
Somerset	1*s.* ,, 3*s.*
Wales and Monmouthshire :—	
Flintshire	1*s.* ,, 3*s.*
Denbighshire ..	1*s.* ,, 4*s.*
Carnarvonshire ..	Little change
Anglesey	1*s.* to 3*s.*
Merionethshire ..	About 2*s.*
Montgomeryshire ..	About 2*s.*
Cardiganshire ..	1*s.* to 2*s.*
Radnorshire ..	1*s.* ,, 3*s.*
Brecknockshire ..	1*s.* ,, 3*s.*
Carmarthenshire ..	1*s.* ,, 2*s.*
Pembrokeshire ..	1*s.* ,, 2*s.*
Glamorganshire ..	2*s.* ,, 3*s.*
Monmouthshire ..	1*s.* ,, 3*s.*

to have participated: in rural districts with 12,478 labourers the mean increase was 6*d.* or under per week; with 99,681 labourers, over 6*d.* and up to and including 1*s.*; with 97,737 labourers, over 1*s.* and up to 2*s.*; with 20,901 labourers, over 2*s.* and up to 3*s.*; and with 11,250 labourers, over 3*s.*

Changes since the Outbreak of War.—From the particulars, so far as reported, of increases granted this year, it is evident that the upward movement in agricultural wages is still continuing.

In the table on p. 375 is given for the various counties the predominant amount of increase in wages since July, 1914, in those rural districts in which wages have been reported as changed. As previously stated, returns have not been received from all rural districts, and in certain other districts no general change in wages has been made. In a few districts the amount of advance falls outside the limits stated for the county, but such cases are exceptional.

Production and Quality of Sulphate of Ammonia.

THE Report of the Chief Inspector of Alkali Works for 1914 (H. C. 253, 1915) shows that there were 624 works or separate processes for the manufacture of sulphate and muriate of ammonia in England and Wales in 1914, as compared with 595 in 1913, and 581 in 1912, the number having steadily increased from 449 in 1904. In Scotland the number of such works was 111. There were also 56 gas liquor works in England and Wales, and 8 in Scotland.

The quantity of sulphate of ammonia produced in the United Kingdom in 1914 is shown in the following table:—

Source.	1914.	1913.	1912.
	Tons.	Tons.	Tons.
Gas works	175,930	182,180	172,094
Iron works	16,008	19,956	17,026
Shale works	62,749	63,061	62,207
Coke oven works	137,430	133,816	104,932
Producer-gas and carbonising works (bone and coal)	34,295	33,605	32,049
Total	426,412	432,618	388,308

The disturbing influence of the war affected the production of most of these different groups of works in 1914.

The standard quality of British sulphate of ammonia has been the subject of discussion, some of the sulphate produced in this country prior to the war being said by foreign consumers to compare unfavourably, to a marked degree, with the product received from Germany. The Sulphate of Ammonia Association has, it is stated, issued directions as to the conditions best calculated to ensure a satisfactory product, but there is wide room for enquiry and research on the question of the manufacture of sulphate of ammonia with the object of getting the best product at low costs.

The question of efficient production is one which is likely to become more prominent as advance is made in the domain of synthetic nitrogenous fertiliser products with attendant reduced costs, increased production, and more severe competition; and centralised effort is recommended as offering the most hopeful expectations and most general advantage.

The exports of sulphate of ammonia in 1914 amounted to 314,000 tons as compared with an estimated home consumption (for all purposes, including manure manufacture) of 106,000 tons. The corresponding figures for 1913 were 325,000 tons and 97,000 tons respectively.

In the table below are shown the imports of the materials used in the fertiliser trade, the principal being mineral phosphates. A proportion of the nitrate of soda imported is used in the manufacture of sulphuric and nitric acids :—

	1914.	1913.	1912.
	Tons.	Tons.	Tons.
Guano	39,285	25,548	14,115
Mineral phosphates	555,605	539,016	520,270
Nitrate of soda	171,910	140,926	123,580

The number of chemical manure works under inspection in 1914 was 183 as compared with 217 in 1901.

International Institute of Agriculture: Bulletin of Agricultural and Commercial Statistics.

THE June number of the Bulletin of Agricultural and Commercial Statistics, published by the International Institute of Agriculture, contains the most recent information received at the Institute on cereal crops in the Northern Hemisphere. Forecasts are given for certain countries where the harvest is already in progress or will soon be commencing. Crop conditions in the various countries may be seen in the Bulletin itself.

The Bulletin contains also information on crops of *flax*, *potatoes*, *cotton*, *tobacco*, *hops*, *vines* and *sugar beet* in certain Northern Hemisphere countries, and on the progress of the sericultural campaign in Bulgaria, Italy, and Japan.

Following the above are some data on the 1914-15 crops in Argentina.

The Agricultural part of the Bulletin finishes with live stock statistical data collected in June, 1914, in the United Kingdom.

In the Commercial part, the Bulletin contains the usual tables of imports and exports of cereals, linseed, and cotton, and also of visible stocks of cereals and of the prices of cereals and cotton on the principal markets, the tables being as complete as present conditions allow.

Notes on Agriculture Abroad.

Federal Agricultural Budget of Canada.—In addition to a permanent annual expenditure of £188,000 authorised under the Agricultural Instruction Act for the various provinces comprising the Dominion, a sum of £689,000 is provided in the Canadian federal agricultural budget for 1915-6. The various items comprised in this total are as follows (*Agricultural Gazette of Canada*, May, 1915) :—

	£
Experimental Farms—Maintenance of Central Farm, and establishment and maintaining of additional branch stations	163,500
Branch of Entomology	4,000
Administration and Enforcement of the *Destruc-* ..	21,000

	£
Development of the dairying industries, and the improvement in transportation, sale, and trade in food and other agricultural products	31,500
Fruit Branch	23,500
Encouragement of cold storage warehouses for the better preservation and handling of perishable food products	42,000
Health of Animals	112,500
Dominion Cattle Quarantine buildings—Repairs, renewals, &c.	3,000
Administration and enforcement of the *Meat and Canned Foods Act*	57,500
Publications Branch	3,000
International Institute of Agriculture, to assist in maintenance thereof and to provide for representation thereat	4,000
Development of Live Stock Industry	114,500
Enforcement of Seed Act, to test seeds for farmers and seed merchants, to encourage the production and use of superior seeds, and to encourage the production of farm and garden crops	29,000
National Biological Laboratory	5,000
Administration and carrying out provisions of the *Agricultural Instruction Act*	5,000
Grant to Dominion Exhibition	10,500
Exhibitions	58,500
Renewing and improving Canadian exhibit at Imperial Institute, London, and assisting in the maintenance thereof	1,000
Total	£689,000

Importation of Live Stock into Argentina.—The Board of Agriculture and Fisheries have been officially informed that the Argentine Government have issued a Decree revoking the prohibition of the importation of live stock from England and Wales. Animals may consequently now be imported into Argentina from any part of the United Kingdom. The exportation of cattle, sheep and swine is prohibited by Proclamation from the United Kingdom, but applications for licences to export may be made to the War Trade Department, 4, Central Buildings, Westminster, S.W.

Notes on Crop Prospects Abroad.

THE *Bulletin of Agricultural and Commercial Statistics* for June, 1915, issued by the International Institute of Agriculture, gives the condition of cereals in the more important countries on the 1st June, as follows (100 being taken to represent the prospect of an average crop):—*Wheat*—Canada, winter 116, spring 103; United States, winter 104, spring 101; Lower Egypt 96; Upper Egypt 101. *Rye*—Canada, 102. *Barley*—Scotland, 100; Ireland, 101; Canada, 99; United States, 104; Lower Egypt, 98; Upper Egypt, 103. *Oats*—Scotland, 100; Ireland, 101; Canada, 98; United States, 104.

Forecasts of Production.—The following estimates of the production of cereal crops are given:—*Wheat*—Italy, 25,254,000 qr. in 1914–15 against 21,174,000 qr. in 1913–14; Russia in Europe (54 governments), winter, 37,678,000 qr., against 26,851,000 qr.; United States, winter, 84,478,000 qr., against 85,601,000 qr.; spring, 34,241,000 qr., against 25,747,000 qr.; India, 47,908,000 qr., against 38,950,000 qr. *Rye*—Italy, 551,000 qr., against 613,000 qr; Russia in Europe (54 govern-

ments), winter, 109,837,000 qr., against 91,836,000 qr. *Barley*—Italy, 1,102,000 qr., against 830,000 qr.; United States, 23,633,000 qr., against 23,387,000 qr.; Japan, 11,698,000 qr., against 10,960,000 qr. *Oats*—Italy, 3,179,000 qr., against 2,751,000 qr.; United States, 132,066,000 qr., against 116,999,000 qr.

Argentina.—The third estimate of the cereal crops places the production of wheat in 1914–15 at 21,053,000 qr., against 14,234,000 qr. in 1913–14; of oats at 5,870,000 qr., against 5,227,000 qr.; and of maize at 39,450,000 qr., against 30,691,000 qr.

Australia.—Sowing of cereals for the agricultural year 1915–16 is proceeding under excellent conditions.

France.—The area under maize on 1st June was officially estimated at 766,000 acres, compared with 1,141,000 acres in 1914, and the area under potatoes at 3,217,000 acres, against 3,781,000 acres last year. The condition of maize was 70 against 69, and of potatoes 75 against 73 in 1914. (80 = good, 60 = fairly good.) (*The London Grain, Seed and Oil Reporter*, 28th and 30th June.)

Canada.—A Bulletin issued by the Dominion Government Census and Statistics Office, states that the estimated area under wheat is 12,896,000 acres, or 1,662,500 acres more than in 1914; under oats, 11,427,000 acres, an increase of 13 per cent.; and under barley, 1,518,000 acres. (*The London Grain, Seed and Oil Reporter*, 19th June.)

United States.—The Crop Reporting Board of the Department of Agriculture, in reporting as to crop conditions on the 1st July, states that the total production of winter wheat is estimated at 668,000,000 bush. as compared with a yield of 684,990,000 bush. last year; spring wheat at 295,000,000 bush. against 206,027,000 bush.; maize at 2,814,000,000 bush. against 2,672,804,000 bush.; oats at 1,399,000,000 bush, against 1,141,060,000 bush.; barley at 208,000,000 bush. against 194,953,000 bush. The condition of rye was 92·0 compared with 92·9 last year. The proportion of last year's wheat crop still in farmers' hands was 3·3 per cent. (*The London Grain, Seed and Oil Reporter*, 8th July).

Argentina.—The *Review of the River Plate* of the 4th June states that the weather during the past week has been most suitable for maize operations. Ploughing is going on in all parts for the new wheat and linseed, and reports are satisfactory.

Fruit and Vegetables.—Holland.—His Majesty's Consul-General at Rotterdam reported that, on the 1st June, prospects for the fruit crop in Holland were generally favourable. *Apples* were very good in Groningen and most other parts of the country. *Pears* were also very good throughout the country, except Gelderland and Leeuwarden, where they were moderate. *Early Cherries* were very good in Limburg and in the Alblasserwaard, good in Gelderland and Overyssel, moderate in the Betuwe, and not good in the Hoeksche Waard. *Late Cherries* were excellent in Limburg and Maas district, and good in Betuwe, Utrecht, Gelderland north of the Rhine and Overyssel. "*English*" *Plums* were good in the south-east of Utrecht and the Alblasserwaard, moderate in Gelderland, Overyssel, and South Beveland, and bad near the Maas and Waal rivers. *Other Plums* were very good in Limburg, good in Utrecht, Overyssel, and Alblasserwaard, fairly good in the

Westland district, and moderate in other districts. *Tomatoes* were fairly good in Overyssel and Utrecht, and in other districts good or very good. Prices were 69*s.* per cwt. *Early Potatoes* were good to very good in Gelderland, Overyssel, Limburg, the greater part of Utrecht, West Friesland, and the Isle of Walcheren, fairly good in the Betuwe and moderate in the Westland. Prices for new potatoes were 10*s.* 6*d.* per cwt.

A further report, dated the 10th June, on the condition of vegetable and other crops, from His Britannic Majesty's Consul-General in Rotterdam, stated that most varieties of beans were good, and prospects for peas were good in the north, but only moderate in the south of the country. Canary seed varied from moderate to good. The crop of caraway would probably be below average; conditions were moderate in North Holland, but good elsewhere. Mustard seed was generally satisfactory. Prospects for potatoes were, on the whole, good, although there were some complaints of irregular development, and night frosts had done some damage. Onions varied from moderate to good, and chicory, which is being more largely cultivated this year in South Holland, offered good prospects.

His Majesty's Consul at Flushing, in a report, dated 18th June, stated that fruit seemed to have suffered somewhat from frost. Cherries, plums, and black currants would not yield as well as was at first expected. Pears had suffered from want of rain. Red and white currants, raspberries, and strawberries promised well.

His Majesty's Vice-Consul at s'Hertogenbosch, in a report, dated 14th June, stated that in his district "Bellefleur" apples promised a big crop, but other kinds would be less abundant. Raspberries and cherries afforded good prospects, plums and gooseberries pretty good, while those for pears were bad. In the same district it was expected that apples and pears would be dear.

France.—His Majesty's Vice-Consul at Caen, in a report, dated 10th June, gave the following information based on a report on the prospects of the fruit crops by Le Directeur des Services Agricoles du Calvados. Cider apples and pears promised plentiful crops as in the last three years, and, as the markets were more limited than before the war, low prices must be expected as in 1914, when they were about 4*s.* per cwt. In the Honfleur district, where table fruits are especially grown, the prospects for wall pears were bad, not exceeding a quarter of an average crop; but standard pears promised a plentiful crop. There would be a moderate yield of currants, and a poor crop of plums.

His Majesty's Consular Agent at Lorient, in a report, dated 15th June, stated that, in the Morbihan Department, an abundant crop of cider apples was expected, and, in view of the stocks of old cider, it was not probable that prices would exceed 50*s.* per ton. William pears would be more or less abundant, according to locality, and a certain amount might be available for export. Table apples promised well; it was too early to give quotations, but they were expected to be about £5 to £6 5*s.* per ton, according to quality. Chestnuts promised an abundant yield. The cultivation of strawberries had considerably developed around Vannes, and some hundredweights would be shipped daily to England from June till September. Cherries were a fairly big crop. It should be possible to export some quantity of the early kinds of plums and greengages.

His Majesty's Vice-Consul at St. Malo, in a report, dated the 18th June, stated that apples, whether for cider, cooking, or table purposes promised an abundant yield in his district. Plums afforded a better prospect than usual; gooseberries and currants were about an average, while cherries were a good medium, if not a large crop.

Hops.—*United States.*—His Majesty's Consul at Portland, Oregon, stated (June 21st) that the hop crop for the State of Washington was expected to be about 45,000 bales, which is slightly less than last year, while that of Oregon was expected to be from 130,000 to 160,000 bales, or slightly larger than last year. The hops were growing very well, the weather having been favourable, but aphides had appeared in a few places. Opening prices for the coming crop had been in some cases as high as 6½*d.*, but at the time of the Report were steady at from 5¼*d.* to 5½*d.* per pound. Very little of last year's crop was said to be left in growers' or dealers' hands.

Agricultural Labour in England and Wales during June.

According to statements in the Board's *Monthly Agricultural Report* for 1st July, the supply of labour was everywhere deficient in greater or less degree; the shortage appeared to have been less felt in the northern counties. The fine weather of the month tended to mitigate the effects of the scarcity, and temporary labour in various districts had been found among the military and women. The conditions in various districts were as follows:—

Northumberland, Durham, Cumberland and Westmorland.—In some districts a deficiency was not much felt, but in others there was a considerable shortage of temporary labour for turnip hoeing and hay making. More Irish labourers than usual were reported to be available in some parts, owing, it was stated, to higher wages.

Lancashire and Cheshire.—Some districts reported a shortage, others were fairly well supplied. The fine weather and light crops made the strain less felt.

Yorkshire.—The supply of labour was generally reported as deficient, but with fine weather and light hay crops this has not been felt as severely as might otherwise have been the case.

Shropshire and Stafford.—Labour was scarce throughout the district.

Derby, Nottingham, Leicester and Rutland.—There was a general deficiency, although owing to the light crops not so much labour was required for hay harvest, and in east Notts assistance was rendered by women and boys.

Lincoln and Norfolk.—Though labour was somewhat deficient, the shortage has not on the whole proved serious up to the present.

Suffolk, Cambridge and Huntingdon.—The supply was generally deficient, but the favourable weather and the light hay crops have assisted matters.

Bedford, Northampton and Warwick.—Labour was short everywhere, but owing to the light crops of hay and the fine weather the shortage so far has not caused much inconvenience.

Buckingham, Oxford and Berkshire.—Casual labour was very difficult to get, but the dry weather has reduced farm work, and the shortage was not so much felt as it would otherwise have been.

Worcester, Hereford and Gloucester.—Labour was short, particularly casual labour for hoeing, etc., and fruit pickers were fewer than usual. The work of the farm was, however, generally got through in most districts; various circumstances, such as fine weather, for the short hay

harvest, and help from women in many localities, having contributed to minimise the effects of a shortage.

Cornwall, Devon and Somerset.—The supply of labour was generally deficient.

Dorset, Wiltshire and Hampshire.—Labour was scarce, but in many districts the fine weather reduced the demand for extra hands for hay-making, and in Dorset farm work was mostly well in hand. Both here and in Hants a good deal of assistance was obtained from the military. In Wiltshire labour was very scarce.

Surrey, Kent and Sussex.—In one or two districts there was not any serious shortage, but generally labour was very scarce. Soldiers were employed in some instances.

Essex, Hertford and Middlesex.—Labour was everywhere short, but in varying degrees, particularly casual labour, but in most places the work was being done. In south Essex pea-pickers were not so numerous as usual; elsewhere women were helping. In Middlesex good wages (especially at piece-work) were being paid for poorer work, and mangold hoeing proceeded slowly.

North Wales.—There was a scarcity of labour, especially among temporary hands for turnip-hoeing.

Mid Wales.—A shortage of labour was generally reported, but the difficulties had not proved acute.

South Wales.—Labour was everywhere more or less deficient, particularly casual workers.

Agricultural Conditions in England and Wales on 1st July.

THE Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales on the 1st July, state that the past month was everywhere a very dry one, nearly every district experiencing a drought until about the 25th or 27th, when rains were fairly general throughout the country. The drought had a more or less injurious effect on all crops except wheat, but the rains in the last few days of June were of great benefit, especially to roots and pastures.

The wheat crop is generally healthy, and was little injured by the dry weather; nevertheless it will hardly prove an average, except in the south-west. Barley and oats have both wanted rain badly, and neither looks like yielding more than nine-tenths of an average crop. Barley is much the better of the two in the north; elsewhere there is not very much to choose between them. Straw is in nearly all districts very short. Beans are more satisfactory, and with wheat approaches more nearly to the average than any other crop; there is, however, much blight in some districts. Peas are less satisfactory, having been less able to withstand the drought.

Potatoes are generally backward. The cold nights prevailing in the first part of June resulted in frosts which did a certain amount of damage among the earlies; the main crop, however, took little harm. The recent rains will probably be of much benefit.

Turnips and swedes have suffered much from fly, and many fields have had to be re-sown, while a large number of farmers have waited for the rain before sowing. Comparatively little is consequently showing above ground. The recent rains should, however, enable much land to be sown and give the crop a start. Mangolds are usually backward for want of rain; they appear quite healthy; indeed there are some quite good fields, although there are many patchy ones.

Very good progress has been made with the clover hay crop, the bulk of which has already been secured in very good condition, although the

quantity is small. Harvesting the meadow hay is in full swing in the south, but has hardly commenced in the later districts; the yield is 20 per cent. below average. In a few districts in Wales and elsewhere the rain proved a hindrance, but this was not the case generally.

Pastures, with few exceptions, became very bare, but great improvement was expected from the rain. Live stock consequently only did fairly well as a rule; in some districts there was a little shortage of milk, and in others cattle were being helped with artificial feeding stuffs.

Hops were not suited by the dry weather and cold nights of June, and the bine is backward. Attacks of aphis have been most persistent, and constant washing has been necessary, but there is little mention of other pests. The outlook at present is for a poor crop.

There was abundant fruit blossom on the trees in most cases, but the dry weather caused a good deal of fruit to fall prematurely, and prospects are not so satisfactory as a month ago. Apples, plums and cherries are very variable, but probably below the average on the whole; pears—also very variable—are more abundant. Among small fruit, strawberries have been a small crop; raspberries should be about average, but currants and gooseberries will probably be poor crops.

Summarising the returns, and expressing an average crop by 100, the condition of the crops on the 1st July indicated probable yields which may be denoted by the following percentages:—Wheat, 98; barley, 90; oats, 90; beans, 98; peas, 95; potatoes, 95; mangold, 90; seeds' hay, 89; meadow hay, 79; hops, 86.

Prevalence of Animal Diseases on the Continent.

The following statement shows that according to the information in the possession of the Board on 1st July, 1915, certain diseases of animals existed in the countries specified:—

Denmark (*month of May*).
Anthrax, Foot-and-Mouth Disease (1,470 outbreaks), Glanders and Farcy, Swine Erysipelas.

France (*for the period 6th–19th June*).
Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox.

Holland (*month of May*).
Anthrax, Foot-and-Mouth Disease (123 outbreaks), Foot-rot, Glanders, Swine Erysipelas.

Italy (*for the period 7th–13th June*).
Anthrax, Blackleg, Foot-and-Mouth Disease (53 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever, Tuberculosis.

Norway (*month of May*).
Anthrax, Blackleg, Swine Fever.

Rumania (*for the period 14th–21st May*).
Anthrax, Dourine, Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Russia (*month of January*).
Anthrax, Foot-and-Mouth Disease (28,287 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Spain (*month of April*).
Anthrax, Blackleg, Dourine, Glanders, Pleuro-pneumonia, Rabies Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (*month of May*).
Anthrax, Blackleg, Foot-and-Mouth Disease, (0 outbreaks), Swine Fever.

Switzerland (*for the period 7th—13th June*).

Anthrax, Blackleg, Foot-and-Mouth Disease (11 "étables" entailing 138 animals, of which 6 "étables" were declared infected during the period), Swine Fever.

No further returns have been received in respect of the following countries:—Austria, Belgium, Bulgaria, Germany, Hungary, Montenegro, Serbia.

The Weather in England during June.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.		Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.
Week ending June 5th:	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours.
England, N.E. ...	52·7	+0·3	0·07	2	— 9	1	7·0	+0·7
England, E.	54·2	—0·3	0·01	0	—12	1	8·3	+1·3
Midland Counties ...	52·8	—1.6	0·08	2	—11	1	7·3	+1·1
England, S.E.... ...	52·5	—3·1	0·02	1	—11	1	7·6	+0·5
England, N.W. ...	51·7	—2·0	0·25	7	— 6	2	7·6	+0·8
England, S.W. ...	51·5	—3·2	0·13	3	— 9	2	8·3	+1·5
English Channel ...	53·7	—1·9	0·16	4	— 9	2	8·8	+0·8
Week ending June 12th:								
England, N.E.... ...	59·0	+5·5	0·04	1	—10	1	8·1	+1·9
England, E.	61·3	+5·9	0·06	2	—11	1	8·0	+1·2
Midland Counties ...	61·0	+5·5	0·10	2	—10	1	8·0	+1·8
England, S.E.... ...	61·4	+4·9	0·09	2	—11	1	6·2	—0·7
England, N.W. ...	58·3	+3·5	0·11	3	— 8	1	6·6	—0·3
England, S.W. ...	59·2	+3·4	0·04	1	—12	1	6·2	—0·8
English Channel ...	59·5	+2·9	0·00	0	—11	0	4·3	—3·7
Week ending June 19th:								
England, N.E. ...	52·9	—1·5	0·00	0	—10	0	9·6	+3·4
England, E.	54·0	—2·1	0·00	0	—13	0	8·6	+2·1
Midland Counties ...	54·6	—1·6	0·00	0	—12	0	10·0	+4·0
England, S.E	55·7	—1·5	0·00	0	—12	0	10·6	+3·9
England, N.W. ...	55·9	+0·2	0·00	0	—12	0	11·8	+5·2
England, S.W. ...	56·7	+0·2	0·01	0	—14	1	10·3	+3·4
English Channel ...	57·9	+0·5	0·08	2	— 8	1	6·9	—1·2
Week ending June 26th:								
England, N.E. ...	53·9	—2·1	0·34	9	— 2	2	5·5	—0·7
England, E.	56·2	—1·6	0·27	7	— 4	3	8·3	+1·5
Midland Counties ...	55·9	—1·7	0·45	12	0	2	6·1	0·0
England, S.E.... ...	57·1	—1·4	0·18	5	— 5	2	6·5	—0·4
England, N.W. ...	55·6	—1·4	0·65	17	+ 2	3	6·2	—0·1
England, S.W. ...	56·0	—1·6	0·97	25	+11	4	3·1	—3·7
English Channel ...	58·6	+0·1	0·81	21	+11	5	3·1	—5·0
Week ending July 3rd:								
England, N.E. ..	59·0	+1·4	0·72	19	+ 8	4	4·2	—2·3
England, E.	61·0	+1·4	1·21	31	+22	4	4·7	—2·7
Midland Counties ...	59·4	+0·2	0·86	22	+10	4	3·4	—3·2
England, S.E.... ...	60·0	—0·2	0·60	15	+ 6	3	5·2	—2·3
England, N.W. ...	58·7	+0·5	1·01	26	+11	5	4·0	—2·4
England, S.W. ...	58·0	—0·3	0·84	21	+ 8	4	4·2	—2·7
English Channel ...	59·2	+0·6	0·14	3	— 7	2	8·9	+0·5

* 1 inch = 25·4 millimetres.

DISEASES OF ANIMALS ACTS, 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	JUNE.		SIX MONTHS ENDED JUNE.	
	1915.	1914.	1915.	1914.
Anthrax:—				
Outbreaks	32	49	358	441
Animals attacked	38	53	401	471
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	11
Animals attacked	—	—	—	74
Glanders (including Farcy):—				
Outbreaks	12	11	25	53
Animals attacked	21	53	39	142
Parasitic Mange:—				
Outbreaks	85	123	*411	1,380
Animals attacked	166	209	*900	2,456
Sheep-Scab:—				
Outbreaks	2	3	156	147
Swine Fever:—				
Outbreaks	491	418	2,332	2,188
Swine Slaughtered as diseased or exposed to infection ...	2,438	4,645	10,777	22,571

* Figures for three months only, the Parasitic Mange Order of 1911 having been suspended from 6th August, 1914, to 27th March, 1915, inclusive.

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	JUNE.		SIX MONTHS ENDED JUNE.	
	1915.	1914.	1915.	1914.
Anthrax:—				
Outbreaks	—	—	1	1
Animals attacked	—	—	1	1
Foot-and-Mouth Disease:—				
Outbreaks	—	1	—	75
Animals attacked	—	9	—	955
Glanders (including Farcy):—				
Outbreaks	—	—	1	—
Animals attacked	—	—	3	—
Parasitic Mange:—				
Outbreaks	13	4	36	49
Sheep-Scab:—				
Outbreaks	14	12	254	347
Swine Fever:—				
Outbreaks	19	12	140	116
Swine Slaughtered as diseased or exposed to infection ...	84	126	823	643

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in June and May, 1915.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	JUNE. First Quality.	JUNE. Second Quality.	MAY. First Quality.	MAY. Second Quality.
FAT STOCK :—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle :—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Polled Scots	13 6	12 5	12 10	11 9
Herefords	13 2	11 10	12 2	10 11
Shorthorns	13 1	11 11	12 3	11 4
Devons	13 2	12 0	12 3	11 5
Welsh Runts	12 11	12 3	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	*d.*	*d.*	*d.*
Veal Calves	10¾	9¾	11	10
Sheep :—				
Downs	11	10	11¾	10¾
Longwools	10¼	9¼	11	10
Cheviots	11¾	10¾	12¼	11¼
Blackfaced	11	10	12	11
Welsh	11	10	12	10¾
Cross-breds	11¼	10¾	11¾	10¾
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs :—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Bacon Pigs	9 4	8 9	9 4	8 9
Porkers	9 8	9 2	9 9	9 2
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ *s.*	£ *s.*	£ *s.*	£ *s.*
Shorthorns—In Milk ...	25 12	20 18	25 6	20 17
,, —Calvers ...	24 15	20 12	23 0	19 17
Other Breeds—In Milk ...	24 1	18 19	21 10	18 15
,, —Calvers ...	18 10	17 10	17 15	16 17
Calves for Rearing	3 6	2 14	3 0	2 8
Store Cattle :—				
Shorthorns—Yearlings ...	13 15	11 15	13 10	11 13
,, —Two-year-olds...	18 7	16 2	18 4	16 3
,, —Three-year-olds	23 3	19 15	22 7	19 9
Herefords —Two-year-olds...	20 1	17 0	21 3	19 1
Devons— ,,	21 6	18 1	20 0	17 4
Welsh Runts— ,,	16 18	15 18	17 1	16 10
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Downs or Longwools ...	54 10	45 8	56 8	50 0
Store Pigs :—				
8 to 12 weeks old	26 3	20 7	24 10	19 3
12 to 16 weeks old	41 0	32 8	41 2	30 10

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in June, 1915.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.	Leeds.	Liverpool.	London.	Manchester.
		per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
		s. d.	s. d.	s. d.	s. d.	s. d.
BEEF :—						
English	1st	90 0	89 0	—	94 0	90 6
	2nd	85 6	85 0	—	89 0	86 6
Cow and Bull	1st	81 0	83 0	79 6	77 6	81 6
	2nd	76 6	74 6	74 0	73 0	76 0
Irish: Port Killed	1st	84 0	79 6	90 6	91 0	87 6
	2nd	—	74 6	85 6	87 0	83 0
Argentine Frozen—						
Hind Quarters	1st	75 0	77 0	76 0	77 6	76 0
Fore ,, ...	1st	69 6	72 6	67 0	67 6	67 0
Argentine Chilled—						
Hind Quarters	1st	84 6	84 0	83 6	83 6	83 6
Fore ,, ...	1st	70 6	69 6	70 0	70 0	70 6
Australian Frozen—						
Hind Quarters	1st	73 0	74 6	75 0	75 0	75 0
Fore ,, ...	1st	68 0	69 6	68 0	67 0	68 0
VEAL :—						
British	1st	87 6	84 0	89 0	87 6	87 6
	2nd	80 6	81 0	76 0	78 6	80 6
Foreign...	1st	—	—	—	93 0	—
MUTTON :—						
Scotch	1st	—	—	98 6	99 6	98 0
	2nd	—	—	94 0	94 6	93 6
English...	1st	95 0	99 0	—	92 6	90 6
	2nd	87 6	94 0	—	86 0	85 0
Irish: Port Killed	1st	98 0	—	91 6	81 6	86 6
	2nd	93 6	—	85 0	77 0	81 6
Argentine Frozen	1st	66 6	66 0	65 0	66 0	65 0
Australian ,, ...	1st	65 0	62 6	62 6	63 0	62 6
New Zealand ,, ...	1st	66 6	66 0	—	68 6	—
LAMB :—						
British	1st	99 0	109 0	98 6	100 0	99 0
	2nd	93 6	100 0	91 0	92 6	91 0
New Zealand	1st	80 6	82 0	82 6	81 6	82 6
Australian	1st	76 6	74 6	74 6	77 6	74 6
Argentine	1st	76 6	75 0	76 0	76 6	75 0
PORK :—						
British	1st	83 0	76 6	76 0	85 0	74 6
	2nd	79 6	73 6	70 6	79 6	68 0
Foreign...	1st	—	—	—	—	—

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in June, 1915.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
BUTTER:—	*s. d.* per 12 lb.	*s. d.* per 12 lb.	*s. d.* per 12 lb.	*s. d.* per 12 lb.	*s. d.* per 12 lb.	*s. d.* per 12 lb.
British	16 0	15 0	—	—	15 3	14 3
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	143 0	141 0	140 0	137 6	142 0	138 6
„ Factory	133 6	130 0	132 6	129 0	133 0	129 0
Danish	—	—	151 6	149 0	151 0	148 0
French	—	—	—	—	138 6	133 6
Russian	—	—	135 0	133 0	132 6	128 6
Australian	—	—	139 0	136 0	141 0	137 0
New Zealand	147 6	146 0	143 6	141 6	144 6	141 0
Argentine	—	—	134 0	132 0	139 0	136 0
CHEESE:—						
British—						
Cheddar	103 0	101 0	103 0	102 0	101 6	97 6
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	90 6	85 6	98 0	93 0
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian	94 6	92 0	93 0	91 0	94 6	91 6
BACON:—						
Irish (Green)	99 0	95 6	96 0	92 0	96 6	93 6
Canadian (Green sides)	89 0	85 6	87 0	85 0	88 0	85 0
HAMS:—						
York (Dried or Smoked)	120 0	116 0	—	—	120 0	116 0
Irish (Dried or Smoked)	—	—	—	—	116 0	111 0
American (Green) (long cut)	77 0	75 0	78 0	74 6	81 0	77 6
EGGS:—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	13 9	12 11	—	—	15 0	14 2
Irish	13 7	13 4	13 8	13 1	14 5	13 11
Danish	—	—	—	—	16 1	14 5
POTATOES:—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Edward VII.	95 6	86 0	85 0	80 0	99 6	89 0
Evergood	80 0	75 0	—	—	86 0	75 0
Up-to-Date	95 6	80 6	68 6	63 6	97 6	88 6
HAY:—						
Clover	—	—	120 0	95 0	112 0	104 0
Meadow	—	—	—	—	106 0	98 6

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1913, 1914 and 1915.

Weeks ended (in 1915).	Wheat.						Barley.						Oats.					
	1913.		1914.		1915.		1913.		1914.		1915.		1913.		1914.		1915.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Jan. 2 ...	30	5	31	1	44	4	28	6	26	2	29	10	19	10	18	2	26	6
,, 9 ...	30	3	30	11	46	2	28	4	25	11	29	7	19	2	18	4	26	5
,, 16 ...	30	5	31	0	48	9	28	6	26	0	30	5	19	4	18	6	27	6
,, 23 ...	30	11	30	11	51	6	28	10	26	3	31	3	19	4	18	11	28	10
,, 30 ...	31	1	31	1	52	8	28	11	26	6	32	5	20	2	19	1	29	10
Feb. 6 ...	31	0	31	0	53	3	28	10	26	7	33	7	20	1	18	9	30	3
,, 13 ...	30	9	31	0	54	8	29	1	26	7	34	7	20	2	18	11	31	1
,, 20 ...	30	11	31	0	56	0	28	8	26	7	34	11	20	7	18	11	31	5
,, 27 ...	31	0	31	0	56	0	28	6	26	6	35	3	20	4	18	11	31	8
Mar. 6 ...	31	3	31	5	55	11	28	5	26	2	34	6	20	0	18	9	31	8
,, 13 ...	31	1	31	6	54	8	27	11	26	0	33	5	20	2	18	7	31	0
,, 20 ...	31	1	31	5	53	9	28	6	25	8	32	2	19	11	18	6	30	7
,, 27 ...	31	3	31	4	54	3	27	6	25	7	31	11	19	7	18	8	30	6
Apl. 3 ...	31	4	31	6	54	6	27	0	25	6	31	9	19	2	18	5	30	6
,, 10 ...	31	3	31	5	54	9	27	8	26	8	31	3	19	2	18	4	30	4
,, 17 ...	31	6	31	7	55	4	26	11	25	4	30	10	18	10	18	4	30	5
,, 24 ...	31	8	31	9	56	5	26	7	26	6	31	5	19	3	18	5	30	11
May 1 ...	32	2	31	9	58	3	25	11	26	0	32	7	19	6	18	5	31	5
,, 8 ...	32	6	32	2	60	5	25	9	25	6	33	3	19	6	18	9	32	4
,, 15 ...	32	10	32	7	61	7	25	4	26	3	34	0	19	9	18	11	32	5
,, 22 ...	32	10	33	0	62	0	25	3	25	10	34	1	19	11	19	0	32	8
,, 29 ...	32	7	33	9	61	11	26	1	26	1	34	8	20	1	19	4	32	7
June 5 ...	32	10	34	0	61	9	26	2	25	11	35	4	19	8	19	4	32	5
,, 12 ...	32	8	34	1	60	1	24	7	24	11	34	5	20	2	19	8	32	4
,, 19 ...	32	8	34	1	56	1	23	10	25	10	34	3	19	8	19	9	31	9
,, 26 ...	32	8	34	3	52	0	24	3	25	4	34	4	19	1	20	0	31	9
July 3 ...	33	1	34	4	49	5	25	2	24	6	35	3	21	0	19	9	31	1
,, 10 ...	33	4	34	2			25	10	24	9			19	4	20	0		
,, 17 ...	33	6	34	1			24	9	24	2			20	5	19	10		
,, 24 ...	33	10	34	0			24	1	24	7			20	8	19	9		
,, 31 ...	34	1	34	2			24	5	25	9			20	3	19	8		
Aug. 7 ...	34	1	34	9			24	9	25	2			19	0	19	1		
,, 14 ...	34	3	40	3			24	7	29	4			18	7	25	1		
,, 21 ...	33	7	38	9			26	5	29	10			18	8	24	3		
,, 28 ...	32	7	36	2			29	0	30	3			17	10	23	5		
Sept. 4 ...	31	11	36	5			30	11	30	6			17	8	23	9		
,, 11 ...	31	9	37	10			31	5	29	11			18	0	23	11		
,, 18 ...	31	7	38	3			30	9	29	5			17	11	23	8		
,, 25 ...	31	6	37	6			30	1	29	3			17	9	23	3		
Oct. 2 ...	31	3	37	1			29	9	29	1			17	10	22	9		
,, 9 ...	31	0	36	8			29	1	28	10			17	10	22	5		
,, 16 ...	30	11	36	7			28	8	28	8			17	9	22	4		
,, 23 ...	30	7	37	2			28	7	28	7			18	0	22	5		
,, 30 ...	30	1	37	10			28	2	28	3			17	9	23	7		
Nov. 6 ...	30	0	38	8			28	1	28	6			17	9	23	7		
,, 13 ...	30	1	39	8			27	8	29	0			17	11	24	8		
,, 20 ...	30	4	41	0			27	5	29	8			18	1	25	5		
,, 27 ...	30	9	41	11			27	0	30	3			18	4	25	8		
Dec. 4 ...	31	2	42	2			26	8	30	2			18	4	25	9		
,, 11 ...	31	2	42	1			26	5	29	11			18	6	25	9		
,, 18 ...	31	2	42	7			25	11	29	8			18	5	25	9		
,, 25 ...	31	0	43	3			25	10	29	9			18	4	25	11		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of June, 1914 and 1915.

	WHEAT.		BARLEY.		OATS.	
	1914.	1915.	1914.	1915.	1914.	1915.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London	35 5	58 5	24 10	35 1	20 2	33 5
Norwich	34 1	58 5	24 9	33 4	18 11	31 9
Peterborough	33 5	54 8	22 2	33 3	19 1	31 8
Lincoln	34 5	56 2	23 3	33 8	20 4	31 4
Doncaster	34 0	54 4	28 2	—	19 8	31 3
Salisbury	33 2	57 4	22 4	34 8	19 8	31 8

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous –

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"*Farmer Giles.*"—Manures and Manuring. (172 pp.) London: "The Smallholder" Offices, 1914. 1*s.* net. [63.16(02).]

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